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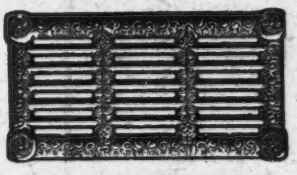

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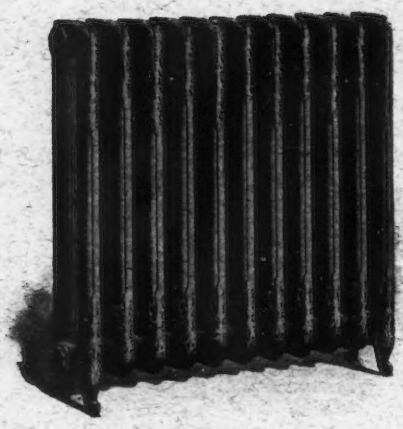

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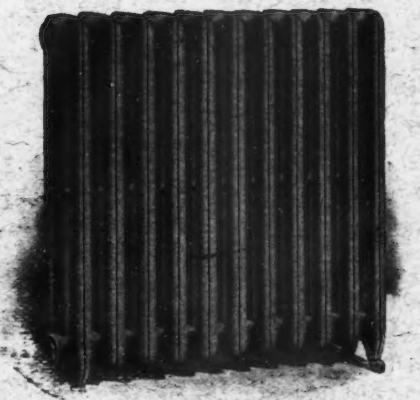

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VOL. V No. 1

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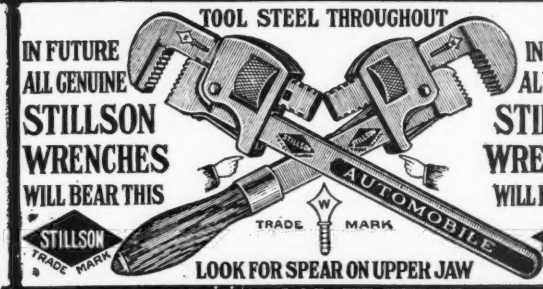
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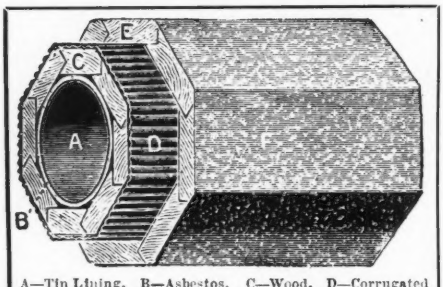
# Steam Economy Talks—1

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# THE HEATING AND VENTILATING MAGAZINE

1123 BROADWAY NEW YORK JANUARY, 1908

HARVARD MEDICAL SCHOOL BUILDINGS, BOSTON, MASS.

## *Mechanical Equipment of the Harvard Medical School Buildings, Boston, Mass.*

The Harvard Medical School in Boston, Mass., an imposing group of buildings, comprises five structures, with their fronts grouped around a quadrangle 215x514 ft. The Administration Building is in the center of the south end of the quadrangle. The group is located on a lot of land containing a little over 26 acres, bounded by Francis street, Huntington avenue, Longwood avenue, and extending beyond Vila street in a westerly direction.

In addition to the buildings mentioned there is a power house located some distance from the main group and beyond that a hospital building. There is also space reserved for some nine additional buildings, and also for the enlargement of four of the main buildings. The general arrangement of the various buildings will be seen by referring to Fig. 1.*

*This and some of the other illustrations were furnished us through the courtesy of *The American Architect and Building News*. We are also indebted to the *Harvard Graduates Magazine* for much of the information contained in the accompanying article.

All of the buildings except the Administration Building, which is in the center and raised above the laboratory buildings by a terrace which takes up the difference in level of the ground from the south side of the buildings to Longwood avenue, consist of two laboratory wings joined together by a lecture-room which is entered at either end, with the libraries of the affiliated departments over it.

A corridor which connects all the buildings passes through the basement of the Administration Building, but is on the ground floor of the others and is carried under the Administration Building terrace. Between the laboratory buildings the corridor is one story above the ground, with only the pipe-tunnel under it.

### MECHANICAL EQUIPMENT

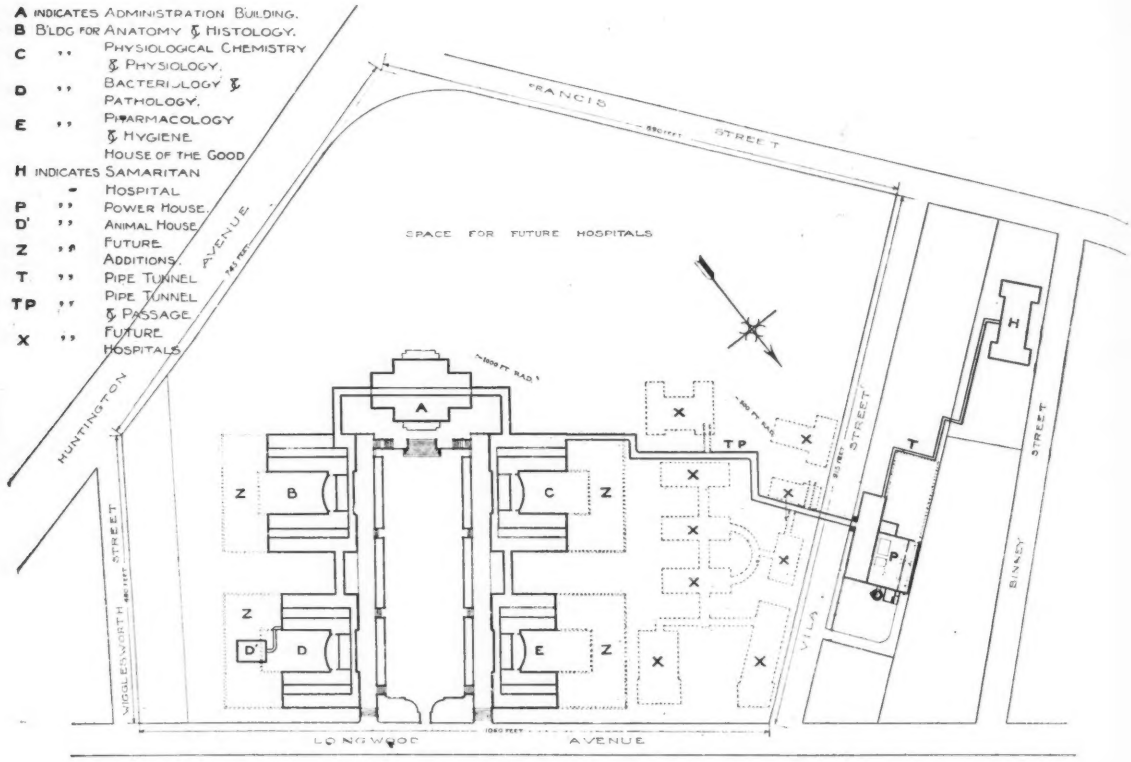
The heating, ventilating, lighting, refrigerating and power plants were worked out by Messrs. Densmore & LeClear, of Boston, in conjunction

with the architects, and the general scheme is as follows:

The central walls on either side of the corridors in all the buildings are hollow and contain all the heating and ventilating flues. The system used is indirect hot-water. The hot, fresh air is forced by fans from a plenum in the basement into the upper part of the rooms and exhaust-fans pull out the foul air from the lower level. In the chemical laboratories the foul air goes out through the hoods as well as the exhaust-ducts. Sufficient direct radiation, however, is installed to keep the buildings moderately heated during the night and Sundays when the fans are not running.

Below the corridor, which gives communication between all the buildings, there is a tunnel which connects with the power-house on Vila street. In this tunnel are carried the hot-water pipes for the heating, hot water for the hot-water service in all the buildings, gas and steam-pipes, electric conduits, brine for the refrigeration and all other necessary pipes. This tunnel is large enough for men to work in freely. In the power-house are installed all the necessary appliances for heating, lighting, refrigerating and power. It is also intended to supply the different hospitals from this same station.

An important consideration in the design of the mechanical plant was the provision for a large but somewhat indefinite increase in the size of the plant, for possible future hospitals or other buildings associated with the school and for the enlargement of the school buildings.




**HARVARD UNIVERSITY MEDICAL SCHOOL,**

**BOSTON, MASS.**

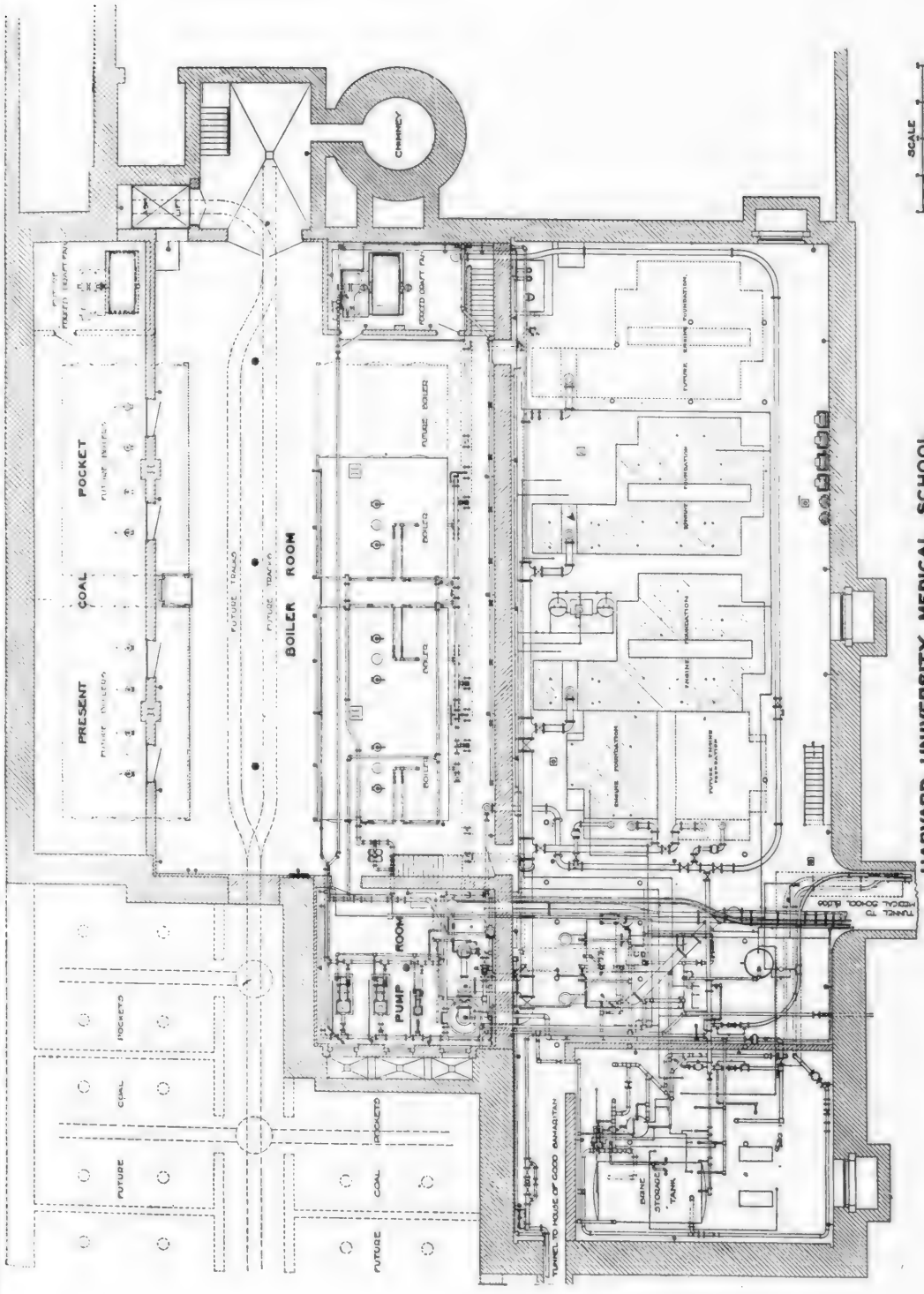
SHEPLEY, RUTAN & COOLIDGE, ARCHITECTS.

MECHANICAL PLANT.
GENERAL PLAN.

DENSMORE & LeCLEAR ENGINEERS, 15 Exchange St., Boston.

SCALE OF 100 0 100 200 300 400 FEET

FIGURE 1




HARVARD UNIVERSITY MEDICAL SCHOOL,
BOSTON, MASS.
BASEMENT PLAN OF POWER HOUSE.

FIGURE 2

The plan of the Medical School grounds, Fig. 1, shows the five school buildings, and the possible additions to them, the power house, the tunnel between the school buildings and the power house, the house of the Good Samaritan Hospital, with its connecting tunnel, and the space reserved for future hospitals. It has been found convenient to designate the five buildings of the school by letters; the Administration Building is known as "Building A," and the four laboratory buildings as "Buildings B, C, D and E;" Building B is for Histology and Anatomy, Building C for Physiology and Physiological Chemistry, Building D for Bacteriology and Pathology, and Building E for Hygiene and Pharmacology.

POWER HOUSE AND EQUIPMENT

Figs. 2 and 3 show the basement plan and first-floor plan of the power house. Fig. 4 shows the steam heating piping in the basements of the various buildings, and Figs. 5 and 6 a cross section of the power house, and a section through the Medical School grounds. The chimney is high enough (175 feet) to carry away the gases and dust and prevent their being blown down into the windows of the hospitals or of the school buildings. The relative heights of the buildings and chimney are shown on the section of the grounds, Figure 6.

The relative grades of the tunnel, sub-basements and building floors are indicated in Fig. 6. The sub-basements are partially excavated as required for heating and ventilating apparatus, electrical switchboards, gas meters and piping, plumbing pipes, etc. The heating mains, electrical cables, brine mains, etc., are run through them and through the connecting passages and the tunnel, special care having been taken in planning their installation to avoid obstructing the passages, and to so arrange them that they can be easily inspected and repaired. A typical cross section and a typical longitudinal section of the tunnel are shown in Fig. 7. The tunnel between the power house and the school buildings makes a convenient passage for the engineer and attendants in charge of the mechanical plant. The pipe tunnel between the power house and the house of the Good Samaritan Hospital, shown in Fig. 1, is not large enough to be used as a service passage.

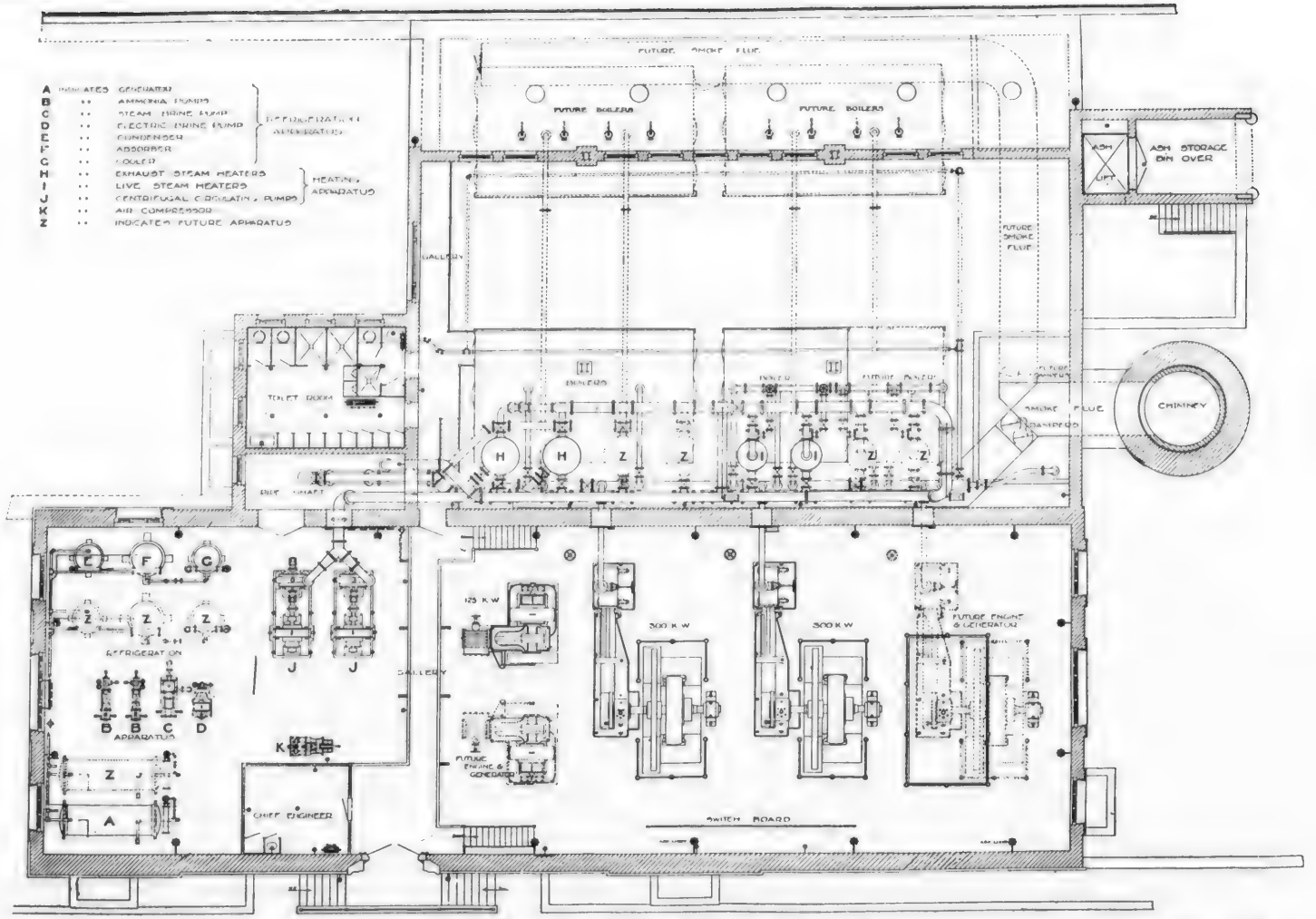
HEATING AND VENTILATING SYSTEM

The buildings are warmed by hot water, heated in tanks or heaters located above the boilers in the power house. Circulation of the hot water through the piping and radiators of the buildings is maintained by means of centrifugal pumps, located in the engine-room. The exhaust steam from all the engines, pumps, etc., in the power house is used for heating the water, supplemented by live steam from the boilers when the exhaust steam is insufficient. Two of the four heaters installed are used for exhaust steam heating only, the other two being reserved for live steam heating. In this way the condensation from the exhaust steam, which contains oil injurious to boilers, can be thrown away, while the condensation from the live steam heaters is returned to the boilers by gravity, without the use of pumps or traps.

The two centrifugal pumps for maintaining the circulation of the hot water are driven by electric motors, one pump and motor being used at a time, and the other held as a reserve. It is to be noted that the exhaust steam from the engines, which drive the generators furnishing current to the pump motors, is used in heating the water of the heating system.

The temperature of the water can be readily adjusted to meet the weather conditions, thus obviating to a large degree overheating, a source of great discomfort.

The buildings are heated, for the most part, by radiators located in the rooms, and ventilation is obtained by introducing fresh air at about the temperature of the room. In some rooms, however, notably dissecting-rooms, direct radiators have been omitted, the heating being done by groups of indirect radiators located in the sub-basements.




HARVARD UNIVERSITY MEDICAL SCHOOL,
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FIRST FLOOR PLAN OF POWER HOUSE

FIGURE 3

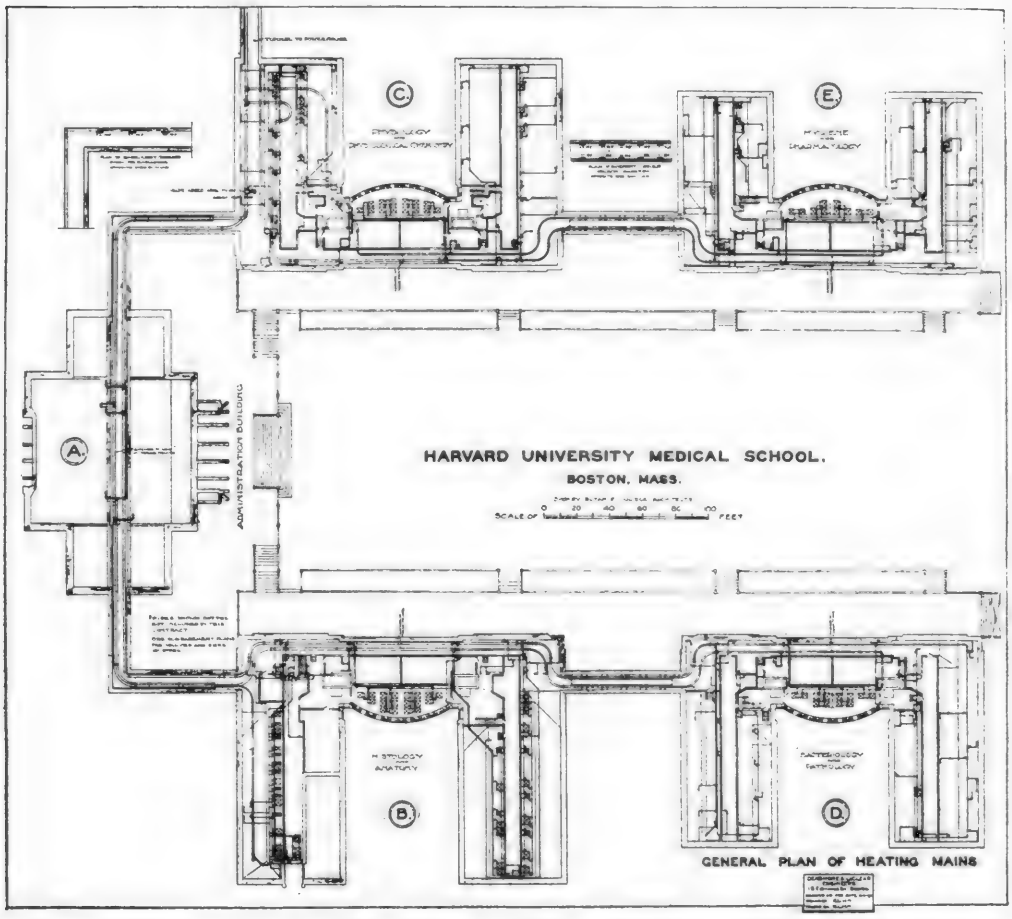



FIG. 4—SHOWING STEAM HEATING PIPING IN THE BASEMENTS OF THE MAIN BUILDINGS

The temperature throughout the buildings is largely regulated by varying the temperature of the water in accordance with the outside temperature, but in addition to this, the radiators are provided with automatically-controlled valves operated by thermostats in the rooms. The temperature of the dissecting-rooms, which are heated by indirect radiators, is controlled by mixing dampers operated from the rooms by hand.

The general system of ventilation in the Laboratory Building is shown in Fig. 8, a typical floor plan. Fig. 9 shows a typical half plan, on a larger scale, and a typical cross-section and a typical longitudinal section through one of the wings. The fresh air for ventilation enters the sub-basements at the rear of the central parts of the building, is heated to the desired temperature by indirect radiators, screened of dust and dirt by special screen bags, and discharged by two inlet fans, motor driven, one for each wing, into main air-ducts or pressure chambers, running the length of the wings, in the sub-basements.

The main air-ducts are of masonry, and are large enough for an attendant to enter them for cleaning, adjusting dampers, etc., and are as free from pipes and apparatus as possible, so that they may be kept clean. The air passes from the main air-ducts to the rooms above through individual galvanized iron ducts, one to each room.

The vitiated air is withdrawn from the rooms through galvanized iron outlet ducts, by means of fans located

on the roofs. There is a main outlet duct on the roof of each wing, into which all the outlet ducts from the rooms connect and from which the outlet fan discharges the vitiated air. These main outlet ducts, like the main air-ducts in the sub-basements, are large enough for an attendant to enter for the purpose of adjusting dampers at the tops of the outlet ducts, for starting and stopping the motors which run the outlet fans, etc. In general, there is one main outlet fan for each wing of each laboratory building, but in special cases additional fans are installed.

year. Mr. C. J. H. Woodbury, of the American Bell Telephone Company, holds a patent covering the fundamental principle of the system. A number of installations in the form used at the Medical School have been made by the engineers and have been found satisfactory.

The temperature of the ventilating air is controlled, as is the temperature of the rooms, largely by the adjustment of the temperature of the water of the heating system to the temperature of the outside air. In addition to this, however, the groups of indirect radiators are provided

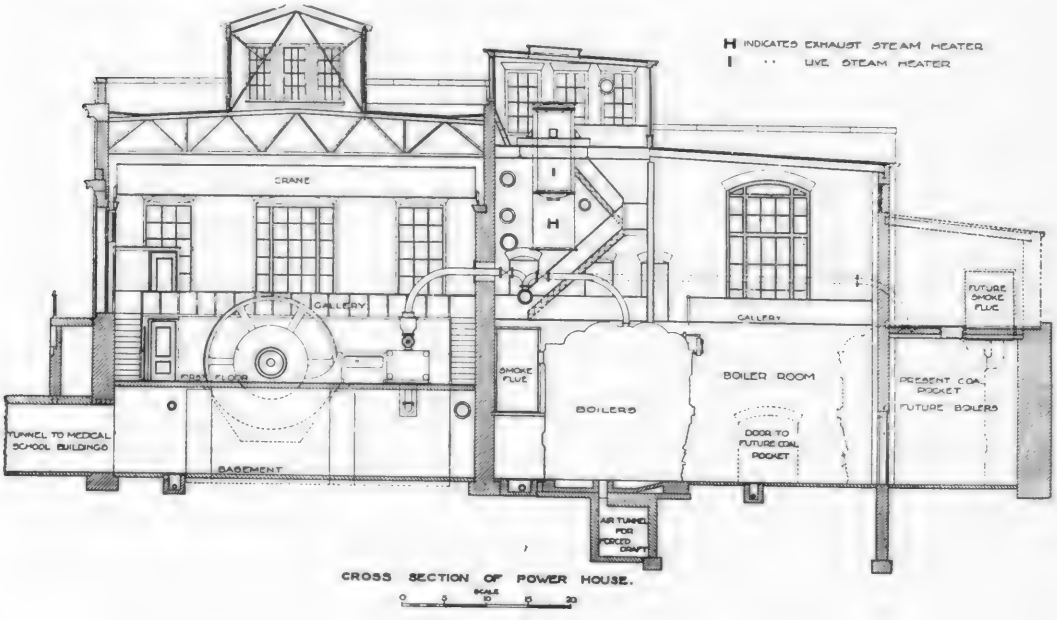



FIGURE 5

The screening of the ventilating air is done by forcing the air through bags made of heavy cotton sheeting. The bags are hung on collars in a galvanized iron ceiling and the air passes down through the open upper ends of the bags and out through the sides, as indicated in Fig. 9. This system makes it possible to obtain a very large area of screening surface with a comparatively small floor area. There are no leaks through which dust and dirt can pass, as in the case with cloth screens on frames, and the bags are readily removed for cleaning, which need not be done more than once a

with by-pass dampers automatically controlled, by means of which cold air is by-passed around the radiators, until the mixture going to the fans is at the temperature desired.

In addition to the outlet fans of the general ventilating system, special fans are located on the roof for ventilating chemical hoods, fume closets etc., and into these fans the outlet ducts from the toilet-rooms are, in general, connected.

There are several "Constant Temperature" rooms where it is desired to maintain a temperature of about 98° F. at all times of the year. These

rooms are heated by indirect steam radiators located in the sub-base-

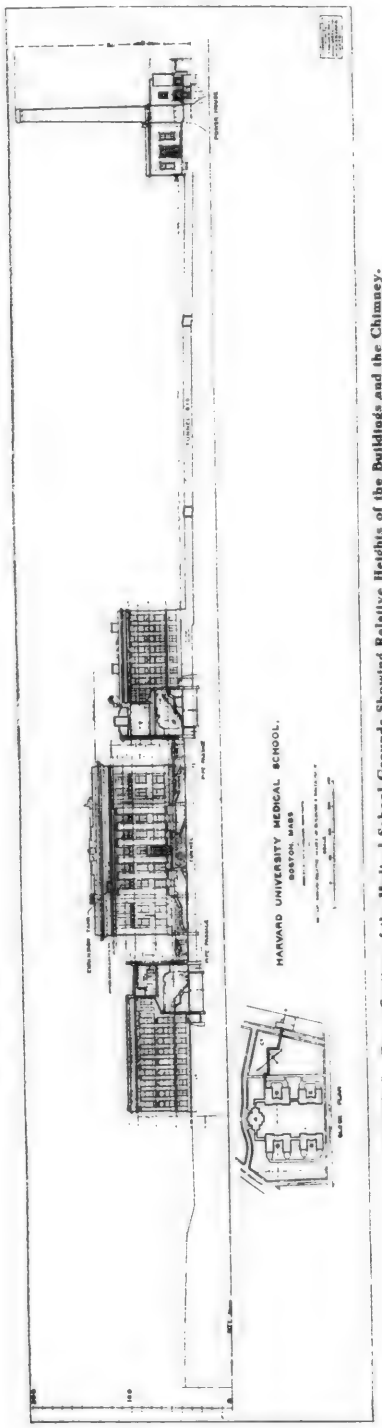



FIGURE 6. Cross Section of the Medical School Grounds Showing Relative Heights of the Buildings and the Chimney.

ments, the steam being taken from the service steam system, which is run for laboratory purposes, and is consequently available whether the heating system is in use or not.

In the Administration Building, the same general system of heating and screening the fresh air for ventilation is used, but the same systematic arrangement of ducts is impossible. The direct radiators on the first floor are recessed into the walls for the sake of appearance and increased floor space. There are no outlet fans, the vitiated air being carried from the building by gravity. The expansion tank for the hot water heating system is located in this building.

### REFRIGERATION

The principal use of refrigeration in the Medical School is the preservation of cadavers, the room for which is located in building B. There are, however, a number of comparatively small cold rooms in the other buildings where refrigeration is necessary. All of the cold rooms are cooled by means of pipe coils through which cold brine is circulated. None of the dissecting-rooms are cooled at present, but space is reserved in the sub-basement of building B, where apparatus for this purpose can be installed when desired.

The refrigeration apparatus is located in the power house, the "absorption" system being used. The special feature worthy of note in connection with this apparatus is that it is designed for the use of exhaust steam from certain parts of the apparatus in the power house. In this connection it is interesting to note that the exhaust steam is used for heating the water in the heating system without back pressure. The cooling of the brine is done by the expansion of compressed ammonia gas, as in most refrigerating installations.

### MISCELLANEOUS SERVICE SYSTEMS

Pipes are run from the power house through the tunnels and sub-basements to the school buildings for supplying steam and compressed air. The steam is carried at about 50 pounds' pressure, and both steam and compressed air are used largely for laboratory purposes.

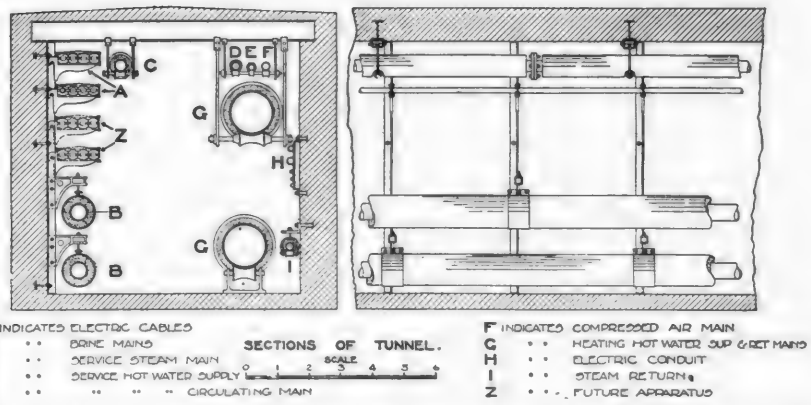
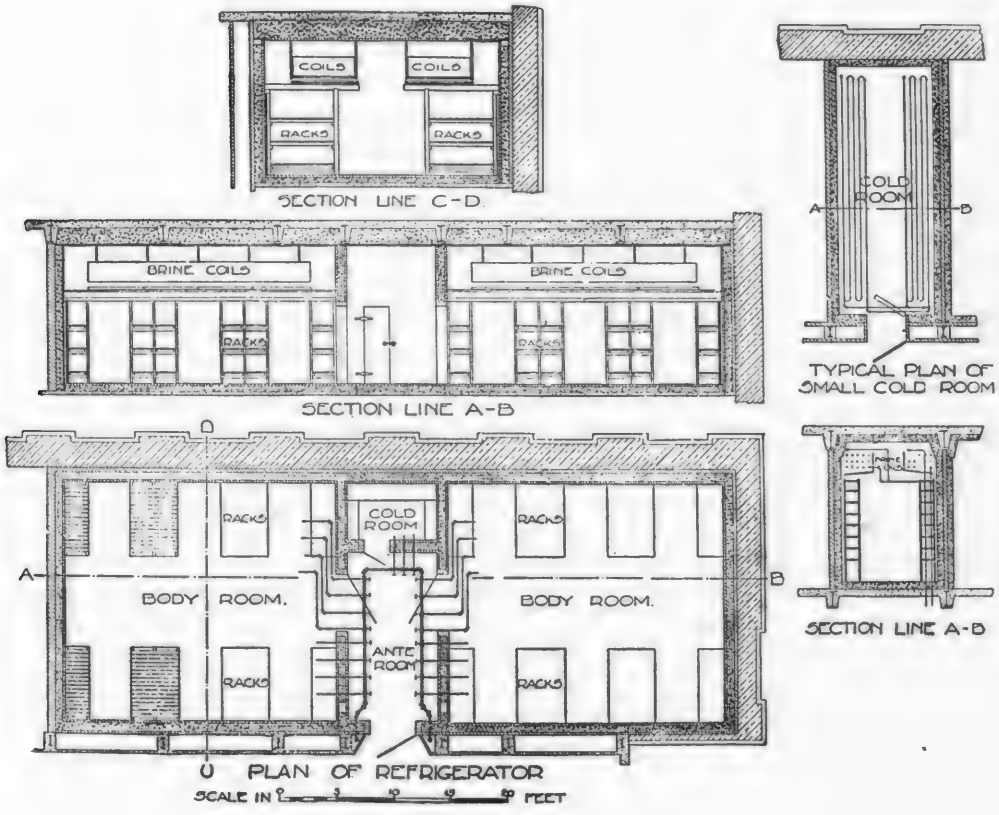

A INDICATES ELECTRIC CABLES
B " BRINE MAINS
C " SERVICE STEAM MAIN
D " SERVICE HOT WATER SUPPLY
E " " " " CIRCULATING MAIN
SECTIONS OF TUNNEL.
SCALE
F INDICATES COMPRESSED AIR MAIN
G " HEATING HOT WATER SUP & RET MAINS
H " ELECTRIC CONDUIT
I " STEAM RETURN
Z " FUTURE APPARATUS

FIG. 7—TYPICAL SECTIONAL VIEWS OF TUNNEL BETWEEN POWER HOUSE AND SCHOOL BUILDINGS



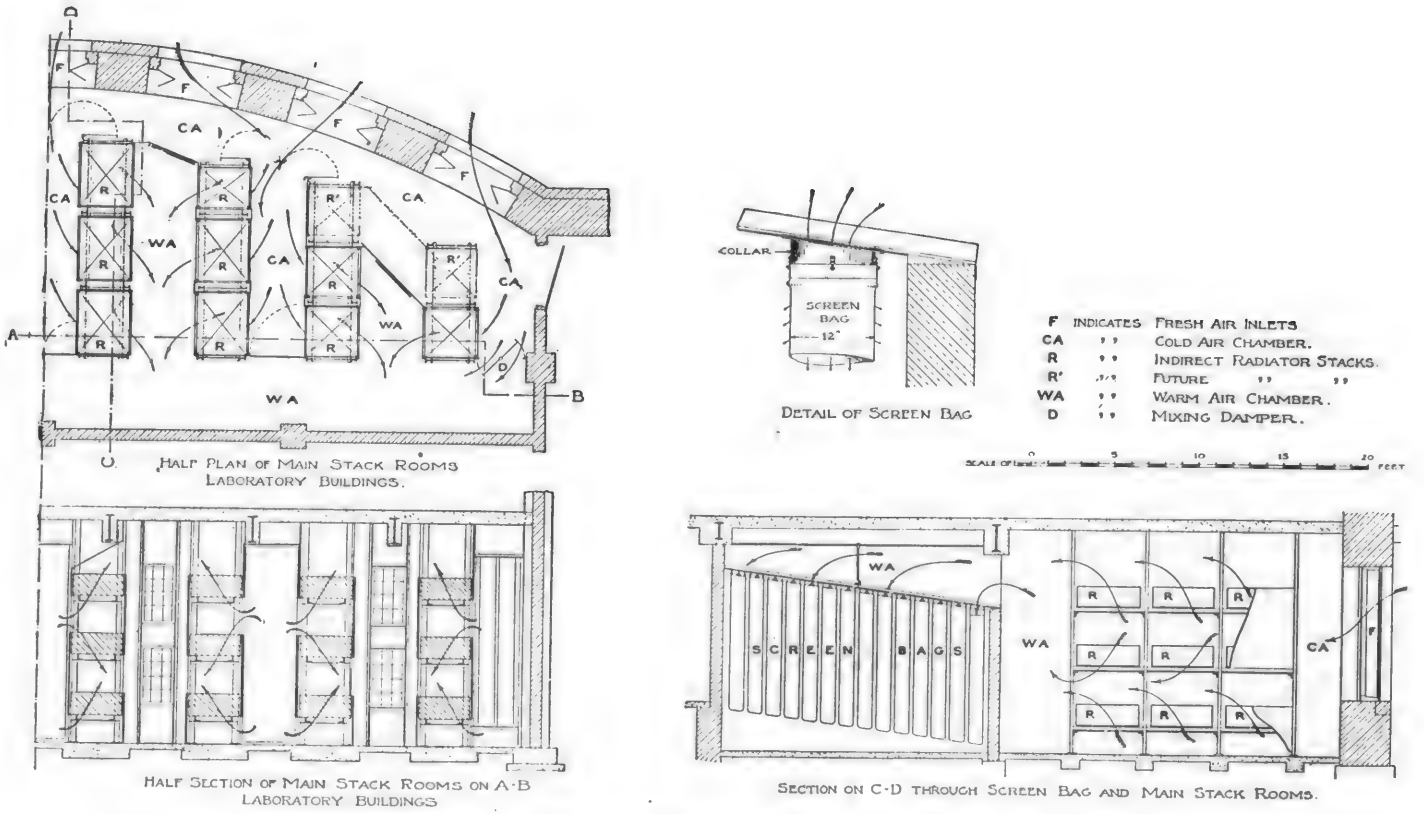



FIG. 8 - TYPICAL PARTIAL FLOOR PLAN OF LABORATORY BUILDING

The air is compressed in the power house by a steam compressor, and is carried at about 50 pounds' pressure to the buildings, where the pressure is reduced through reducing valves. through the same main from the power house as far as building C, but from this point separate mains are run through the sub-basements. In each building there is a storage

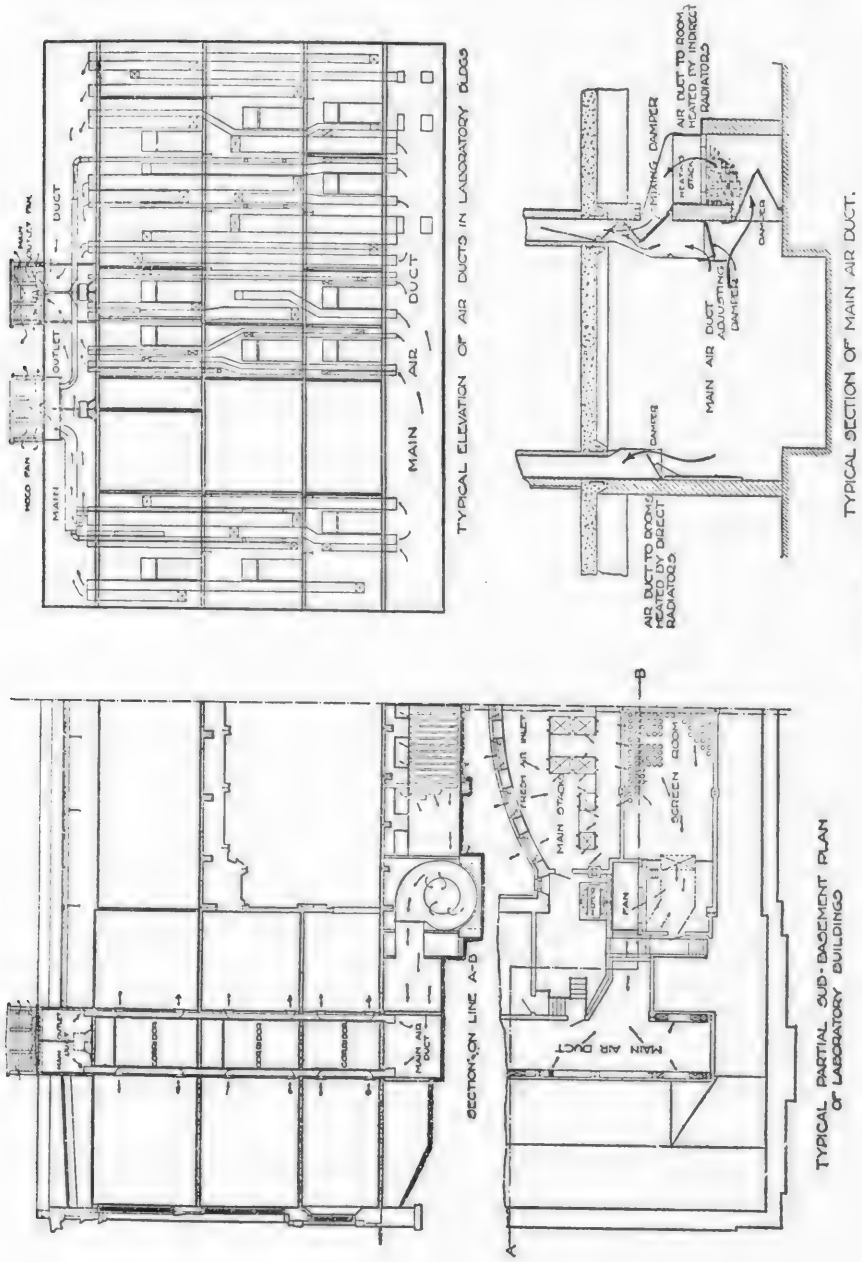

TYPICAL ELEVATION OF AIR DUCTS IN LABORATORY BLDGS
MAIN AIR DUCT
OUTLET DUCT
TYPICAL SECTION OF MAIN AIR DUCT.
AIR DUCT TO ROOMS HEATED BY INDIRECT RADIATORS
MIXING DAMPER
MAIN AIR DUCT ADJUSTING DAMPERS
AIR DUCT TO ROOMS HEATED BY DIRECT RADIATORS
TYPICAL PARTIAL SUB-BASEMENT PLAN OF LABORATORY BUILDINGS
SECTION LINE A-B
MAIN AIR DUCT
SCREEN ROOM
FAN

FIGURE 9

Compressed air is also required throughout the buildings for the automatic control of radiator valves, mixing dampers, etc. The air used for these purposes is supplied tank, reducing valve and filter, from which small pipes are run to the various valves, dampers, thermostats, etc. Advantage is also taken of the compressed air system to locate nozzles

near the electrical machinery, in the power house, for cleaning the commutators, armatures, etc.

The service hot water is heated in the power house in two heaters, one using exhaust steam and the other live steam; the latter being used only when sufficient exhaust steam is not available. The circulation of the water in the mains is maintained by means of a small centrifugal pump, driven by a motor.

A system of "thermophones" is installed, by means of which the engineer in charge at the power house can tell the temperature of the air in each of the main air ducts, and in the cold rooms.

## AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS

## *Fourteenth Annual Meeting, New York, January 21-23, 1908*

The prominent feature of the forthcoming meeting of The American Society of Heating and Ventilating Engineers will be the reports of committee work done during the year. The report of the fan-blast heating committee, for instance, is a document that will reflect much credit on those who have collected data on this subject, while the hot-water heating committee's report shows exceptional care and conscientious investigation in an effort to obtain reliable information for the society. Following is the programme for the meeting:

TUESDAY, JANUARY 21.

1-2 P. M. Reception to visiting members and their ladies, in the meeting room of the Engineering Societies' Building, 29 West 39th street.

2 P. M. Opening professional session. Roll call. Reading of minutes of previous meeting. President's address. Reports of secretary, treasurer, board of governors, standing committees and special committees. Appointment of tellers. New business.

8 P. M. Report of tellers.

Report of committee to collect data on fan blast heating. William G. Snow, chairman.

TOPICS FOR DISCUSSION:

No. 1. "Under actual working conditions what is the condensation per square foot in hot blast heaters?"

No. 2. "Are there practical working formulæ for figuring the size of steam supply for hot blast heaters?"

WEDNESDAY, JANUARY 22.

2 P. M.

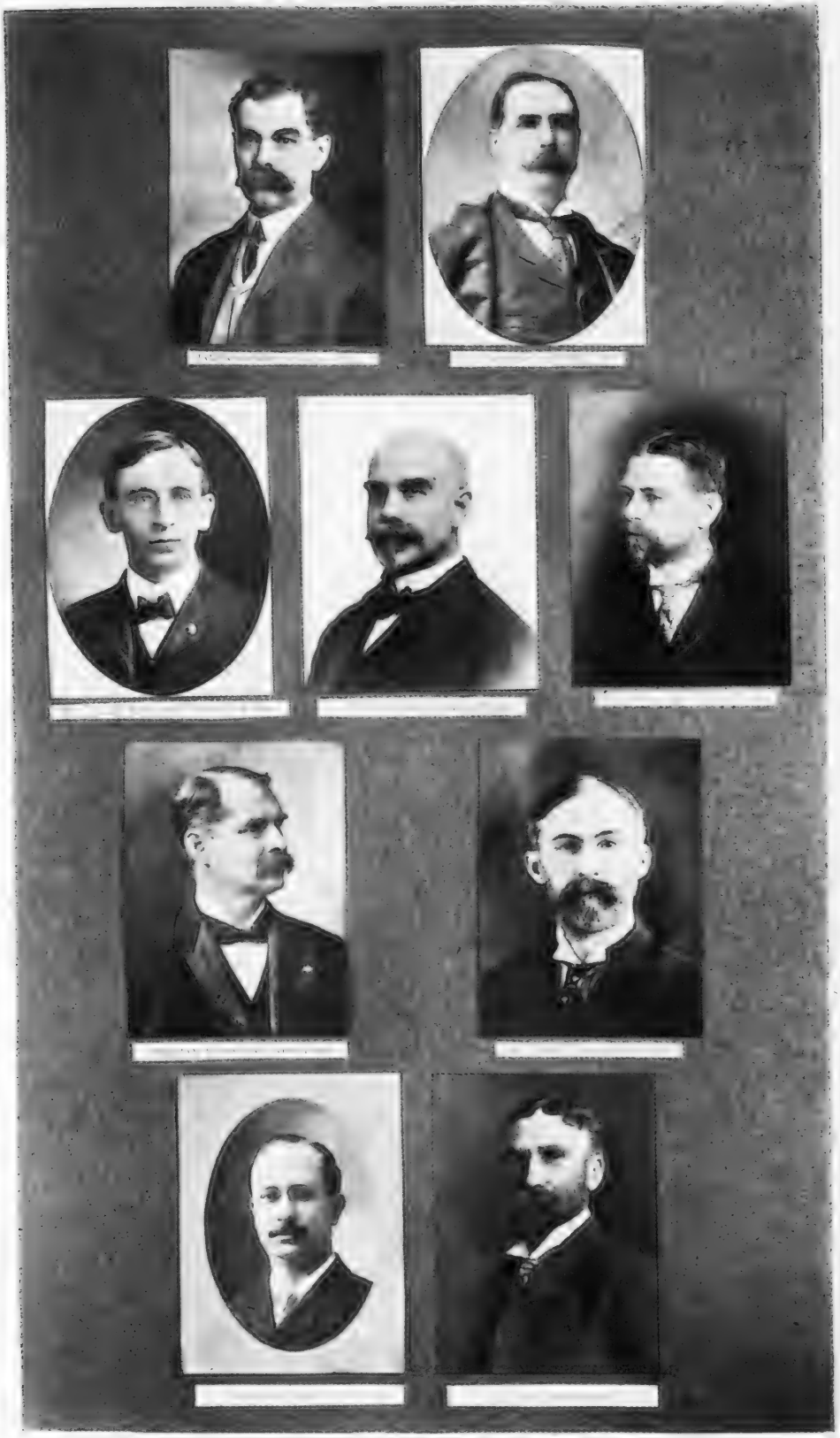
Paper—"The Transmission of Heat Through Radiator Surfaces at Various Temperatures," by John R. Allen.

Report of committee to collect data on hot water heating for residences, James Mackay, chairman.

TOPICS FOR DISCUSSION:

No. 3. "The Austrian Co-efficients for the Transmission of Heat through Building Materials."

No. 4. "The additional amount of radiation seeming advantageous for warming rooms exposed to the strongest wind effect."



NOMINEES FOR OFFICE FOR 1908, AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS

NOMINEES FOR BOARD OF GOVERNORS FOR 1908. AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS

8. P. M. Annual reception and dinner at the New Grand Hotel.

THURSDAY, JANUARY 23.

10.30 A. M.

Paper—"Relative Corrosion of Wrought Iron and Soft Steel Pipes," by T. N. Thomson.

TOPICS FOR DISCUSSION:

No. 5. "Air Washers, their Construction and Effect."

No. 6. "Testing and Rating House Heating Boilers."

No. 7. "Air Circulation in Furnace Heating Systems."

Paper—"Fuel Economy," by L. J. Wing.

Installation of officers.

TOPICS FOR DISCUSSION:

No. 8. "The Efficiency of Small Electric Fans."

No. 9. "Motive Power for Fans."

No. 10. "Ventilation with Aspirating Coils."

No. 11. "Temperature of Smoke Flue with Heating Apparatus."

No. 12. "Late Advances in Heating Below Pressure."

# Relative Corrosion of Wrought Iron and Soft Steel Pipes*

By T. N. Thomson

T. N. THOMSON

THE physical properties of wrought iron and steel pipes have been brought to my attention during the past few years, and I have spent considerable time trying to determine whether modern soft steel pipe is really superior or inferior to modern wrought-iron pipe for heating and plumbing purposes. The matter was originally brought to my attention by the pipe manufacturers, who stated that we are wrong in supposing that steel pipe is less durable than wrought-iron pipe. Indeed, they showed me the results of numerous tests which demonstrated that, as far as corrosion is concerned, the life of wrought iron and the life of soft steel are practically the same when the pipes are subject to the same conditions.

I did not doubt the records of these tests at all, but as they were principally laboratory tests I could not consider them as convincing as the condemnation of steel pipe by steamfitters and contractors. Then we tried to investigate along practical lines. I had not gone far when we found that a peculiar condition of affairs exhibited itself as follows:

(1) A large proportion of the members of the heating trade denounced steel pipe, because, as they said, "It splits, breaks the teeth of the dies and rusts out too quick." Contractors who would acknowledge that they carried steel pipe on stock a few years ago could scarcely be found; they invariably all supposed they carried only wrought-iron pipe.

(2) Engineers and architects very freely specified that "wrought-iron pipe (not steel pipe) must be used, etc., their impression being that the increased cost of wrought-iron pipe over steel pipe was more than compensated for in the greater period of usefulness of the wrought-iron pipe over the steel pipe.

(3) Instructors in trade schools, professors in colleges, and even the writers of text-books were known to emphasize the supposed fact that steel pipe was not as durable as wrought-iron pipe, and that the latter should be used in preference to the former, particularly for underground work.

(4) On the other hand, statistics showed that the makers of steel pipe furnished about 80% of all the welded pipe then used in America. I also found that not only had the makers of steel pipe spent millions of dollars in the development of vast plants, but that they had also made a large number of experiments and tests to determine the relative durability of wrought-iron and steel pipes, and that their findings were invariably to the effect that the life of these two materials is about the same when they are subject to equal conditions.

(5) Wrought-iron pipe and steel pipe resemble each other so closely that many engineers, contractors, architects, and even steamfitters themselves, cannot distinguish a difference. I know this to be a fact, for I have tried a number of high-class representatives of these several vocations, and they almost all acknowledged that they could not determine the difference unless they were first to cut and thread the pipes; then those pipes which appear most difficult to thread they would christen steel pipes, while those which appear more easy to thread they would call wrought-iron pipes. But this process of determining a difference is not reliable, for it is a fact that a man working with sharp and properly designed

*Read at the January, 1908, meeting of the American Society of Heating and Ventilating Engineers.

dies can thread steel pipe almost as easily as he can thread wrought-iron pipe. This was demonstrated by a series of tests I made for the International Correspondence Schools in 1905, full records of which can be found in the 1905-1906 proceedings of this society.

METHOD OF INVESTIGATION

As by far the greater part of the every-day work of our students in heating and ventilation is principally the manipulation of welded pipes, we considered this subject of sufficient importance to investigate and try to find something absolutely definite regarding the relative corrosion of modern wrought iron and modern mild steel pipes when both are subject to the same actual working conditions as they occur in practice. With this end in view we commenced by quietly circularizing about 300 heating engineers and contractors, offering a book to each in exchange for a small piece of corroded pipe which had been in service only a few years, we to pay express charges at our end. Each circular letter was accompanied by a sheet with printed questions relating to the history of the sample, and was provided with blank spaces for the answers.

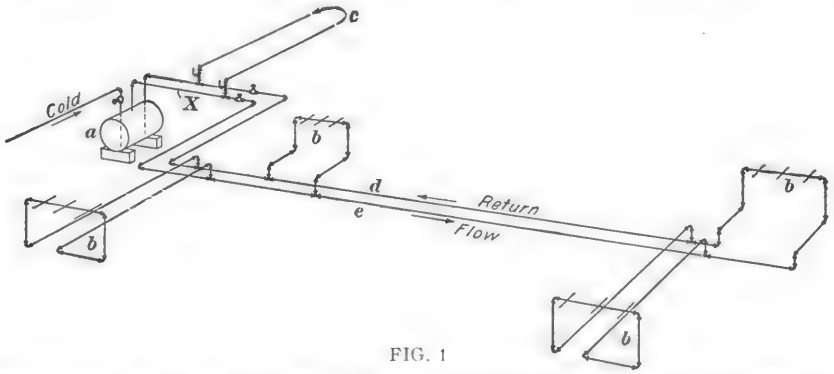



FIG. 1

My object in trying to obtain these samples and their histories was to find how many were wrought iron and how many were steel. I expected to find that at least 80% of the samples of corroded pipe sent to me would be steel, but they were not. Of the samples received only ten gave out within four years of service, six of these being steel and four being wrought iron. An examination of these samples showed that uniform corrosion took place in both the wrought-iron and the steel pipes. An excellent example of uniform corrosion of a ⅜-inch black wrought-iron underground cold-water pipe came from Chicago. It had been in use three years; fully half of the metal was "eaten off" the outside, while the inside was but slightly corroded. There was no pitting present in this sample.

Another good example of uniform corrosion was exhibited in a piece of 1½-inch black wrought-iron exhaust pipe from power boilers in Tonawanda, N. Y. This had lain in damp soil and ashes four years before giving out. The thickness of this pipe varied from about one-half the original thickness to tissue paper thickness, but no pitting was present. The corrosion was chiefly external, and no doubt was due to the moisture and the ashes. But a better example of uniform corrosion was found in a piece of 2-inch steel pipe from Boston. The pipe was used as a wet return for a direct-radiation low pressure heating system, the pressure never exceeding 3 pounds. This pipe was put in February, 1904, and was removed March, 1905. The pipe was run on top of a cement floor over which was a plank floor on which coal was stored. Some of this coal worked down through the wood floor so that the pipe was partially buried in coal. After each heavy rain some surface water would leak through into the coal bin, so that it is probable the coal around the pipe was continually

moist. The pipe was not covered with pipe covering. The corrosion was all external. The inner surface was not corroded in the least.

Three galvanized nipples were received from one party in Newark, N.J. They were reported to have been all taken from the same pipe line, which was used for hot-water circulation between a tank and a heater for a house supply of hot water. Two of these nipples were wrought iron and one was steel. They were all pitted to about the same extent.

A study of the samples received from the trade would lead me to assume that (1) both wrought-iron and steel pipes which convey steam or hot water will corrode very rapidly when buried underground in wet or damp soil or ashes, the corrosion being principally external; (2) both wrought iron and steel pipes which convey hot water become rapidly corroded if the air and other gases naturally solvent in the water are not permitted to escape from the water previous to its passage through the pipes, as in feed-water heater connections and hot-water circulation pipes for plumbing purposes, this corrosion being principally internal if the pipes are not buried underground. (3) That the life of either wrought-iron or steel pipes subject to both of the aforesaid conditions will be much shorter than if the pipes are subject to only one of them, because the metal will thus become rapidly corroded at both the internal and external surfaces. (I received no samples which show this, neither have I made tests to prove it, but it seems rational to form this opinion at present.) (4) It is not a fact that the destruction of wrought-iron pipes is in the form of a uniform corrosion, while the destruction of steel pipes is in the form of pitting; they appear to be on an average nearly alike, with the difference, if any, in favor of steel.

Of course no definite conclusion can be drawn from the study of a number of pieces of corroded pipes received from different parts of the country further than the facts we can see in the samples themselves; for instance, the finest sample of uniform corrosion I received was mild steel. It came from Milwaukee, Wisconsin, is ¾-inch black steel pipe and is reported to have been used "for heating water in a range boiler for domestic purposes." It was in use two years. The corrosion is practically uniform without a sign of pitting. Part of the original thickness of the metal was corroded from the inside and about two-thirds from the outside. The pipe, which, no doubt, was originally standard weight, is now about 1-16-inch thick at its thickest part and tapers down to tissue paper thickness in several places.

To secure a record of facts regarding the period of usefulness of steel pipe as compared with wrought-iron pipe it is necessary to test a large number of samples of both steel and iron pipes subject to exactly the same conditions, and these conditions must be the same as the conditions of practice.

On March 7, 1906, I installed a number of pieces of wrought-iron and steel pipe for a corrosion test at the ceiling of the engine room in the Instruction Building of the International Correspondence Schools in Scranton, Pa. (Fig. 1), with the object of determining definitely whether steel pipe will last as long, or longer, than wrought-iron pipe, and by how much. The existing conditions were as follows:

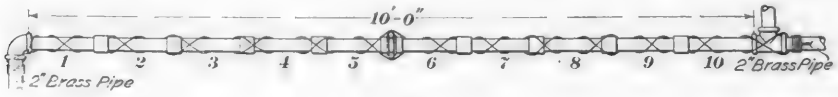



FIG. 2

A 100-gallon galvanized iron boiler *a* in the engine room is set horizontally on two cast-iron cradles supported on brick piers. This boiler furnishes hot water to 24 combination cocks at four press-room sinks as at *b* and four slop sinks *c*. The

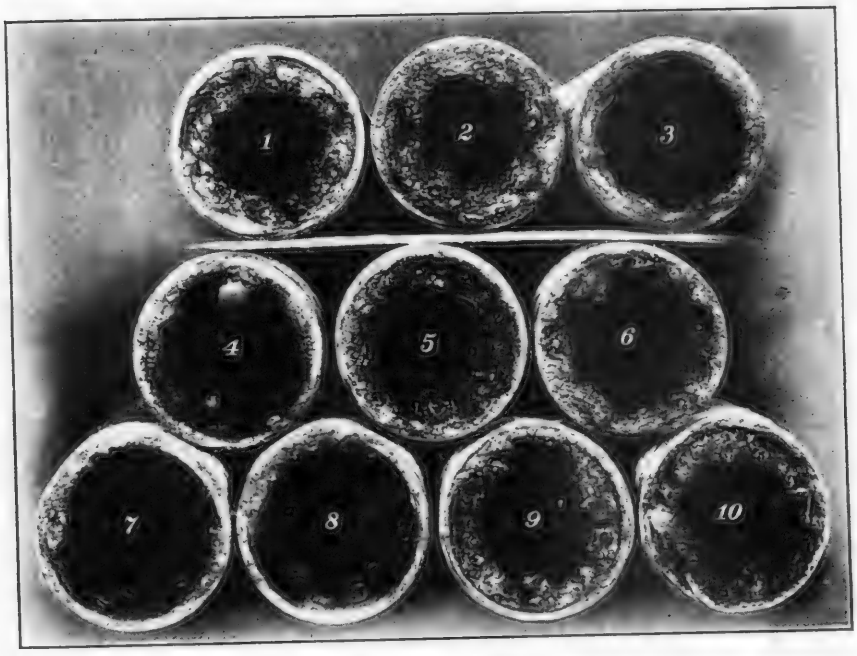



FIG. 3

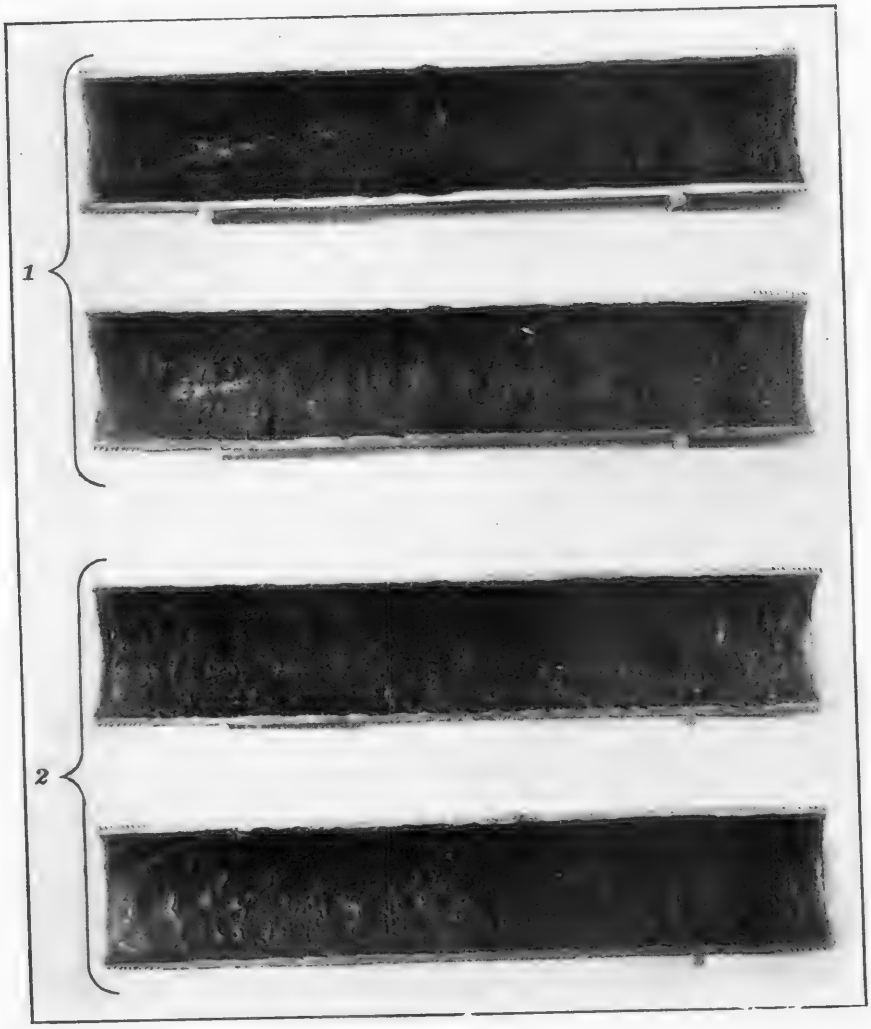



FIG. 4

TABLE I.

| | No. 1 | | No. 2 | | No. 3 | | No. 4 | | No. 5 | | No. 6 | | No. 7 | | No. 8 | | No. 9 | | No. 10 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Kind of Pipe | Blk.W. Iron | | Blk. Steel | | Galv.W. Iron | | Galv. Steel | | Blk. W. Iron | | Blk. Steel | | Galv.W. Iron | | Galv. Steel | | Blk.W. Iron | | Blk. Steel | |
| Weight without coupling when put in. | 3 13/64 lb | | 3 3/32 lb | | 3 15/32 lb | | 2 25/32 lb | | 3 3/32 lb | | 3 5/32 lb | | 3 10/32 lb | | 3 18/32 lb | | 3 7/64 lb | | 3 3/32 lb | |
| Weight without coupling when removed and rust washed out. | 2 26/32 lb | | 2 20½/32 lb | | 3 13/32 lb | | 2 23/32 lb | | 2 20½/32 lb | | 2 19/32 lb | | 3 6/32 lb | | 3 15½/32 lb | | 2 21½/32 lb | | 2 18/32 lb | |
| Loss in weight by corrosion | 6 1/4 oz. | | 7 3/8 oz. | | 1 oz. | | 1 oz. | | 7 3/8 oz. | | 9 oz. | | 2 oz. | | 1 1/4 oz. | | 7 1/8 oz. | | 8 1/2 oz. | |
| Per cent. loss | 12.2% | | 14.9% | | 1.8% | | 2.2% | | 14.9% | | 17.8% | | 3.8% | | 2.2% | | 14.3% | | 17.2% | |
| | 1 | 1X | 2 | 2X | 3 | 3X | 4 | 4X | 5 | 5X | 6 | 6X | 7 | 7X | 8 | 8X | 9 | 9X | 10 | 10X |
| Depth of five deepest pits in each half of each sample in inches. | .078 | .060 | .056 | .031 | .048 | .030 | .055 | .092 | .073 | .057 | .053 | .065 | .048 | .050 | .049 | .041 | .045 | .062 | .051 | .056 |
| | .078 | .083 | .045 | .089 | .043 | .042 | .044 | .082 | .072 | .045 | .046 | .073 | .059 | .027 | .031 | .040 | .044 | .066 | .037 | .052 |
| | .072 | .074 | .088 | .071 | .038 | .049 | .045 | .058 | .062 | .062 | .063 | .053 | .055 | .080 | .042 | .025 | .057 | .075 | .043 | .066 |
| | .080 | .076 | .089 | .083 | .029 | .023 | .038 | .070 | .073 | .058 | .033 | .033 | .070 | .074 | .026 | .048 | .069 | .054 | .041 | .067 |
| | .072 | .059 | .099 | .075 | .029 | .016 | .038 | .050 | .050 | .056 | .042 | .065 | .049 | .098 | .041 | .046 | .042 | .050 | .062 | .045 |
| | 1 | 1X | 2 | 2X | 3 | 3X | 4 | 4X | 5 | 5X | 6 | 6X | 7 | 7X | 8 | 8X | 9 | 9X | 10 | 10X |
| Thickness of metal under pits in inches. | .076 | .094 | .098 | .093 | .106 | .124 | .099 | .082 | .081 | .097 | .101 | .089 | .106 | .104 | .105 | .113 | .109 | .092 | .103 | .098 |
| | .076 | .071 | .109 | .085 | .111 | .112 | .110 | .072 | .082 | .109 | .108 | .081 | .095 | .127 | .123 | .114 | .110 | .088 | .117 | .102 |
| | .082 | .080 | .098 | .083 | .116 | .105 | .109 | .086 | .092 | .092 | .091 | .101 | .099 | .094 | .112 | .129 | .097 | .079 | .111 | .088 |
| | .074 | .078 | .085 | .091 | .125 | .131 | .116 | .084 | .081 | .096 | .121 | .101 | .084 | .080 | .128 | .106 | .085 | .100 | .113 | .087 |
| | .082 | .095 | .085 | .079 | .125 | .138 | .096 | .104 | .104 | .098 | .112 | .089 | .105 | .086 | .113 | .108 | .112 | .104 | .092 | .109 |

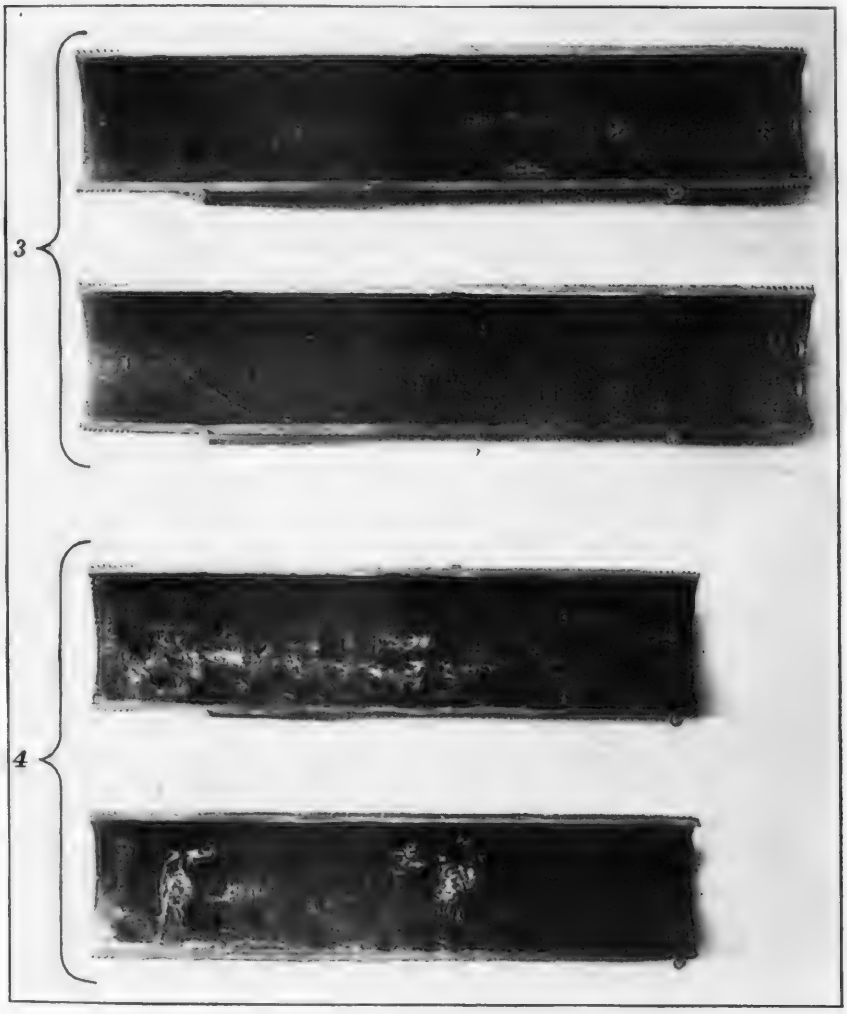



FIG. 5

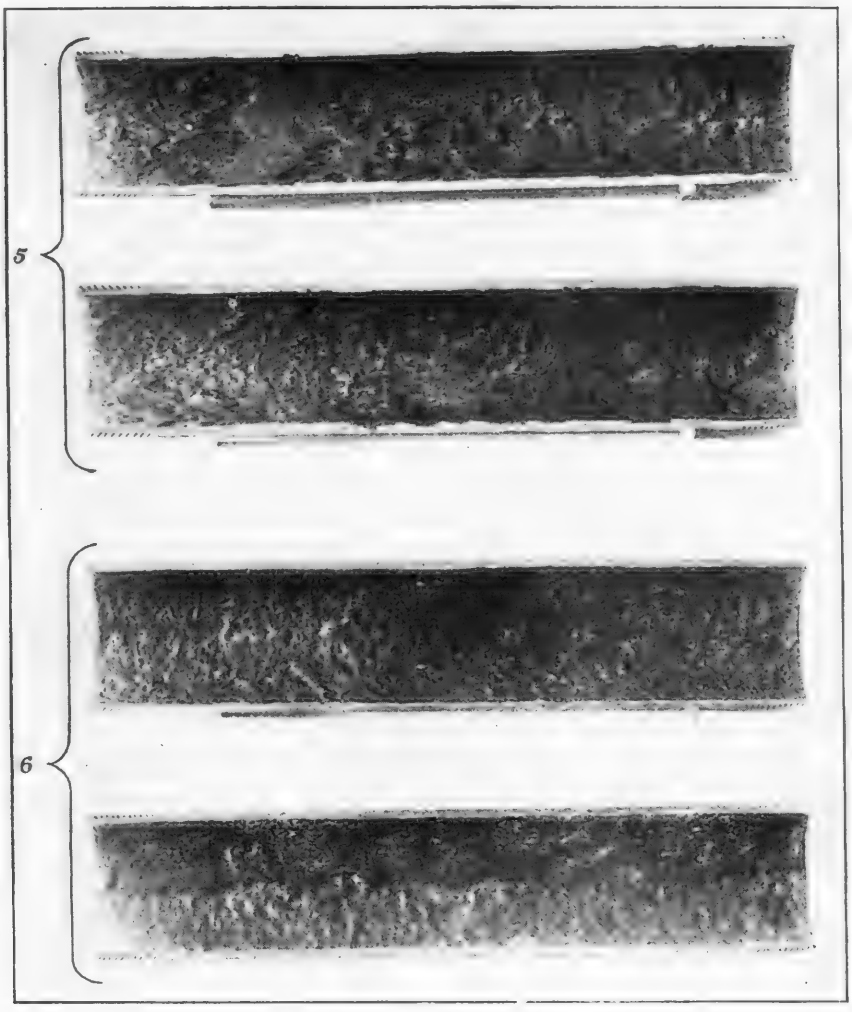



FIG. 6

water is heated by a 1-inch brass steam coil inside the boiler. The water comes from our city mains and has a working pressure varying from 85 pounds to 135 pounds per square inch by the gauge. This water comes from enormous reservoirs in the mountains about twelve miles away. An analysis of the city water made while the pipes were under test was as follows:

TABLE I

| | Parts per Million |
|---|---|
| $CO_2$ and Organic matter | 29.33 |
| Silica | 4.00 |
| Iron oxide | 0.43 |
| Alumina | 0.37 |
| Calcium carbonate | 4.82 |
| Magnesium | Trace |
| Sulphur trioxide | Trace |
| Sodium chloride | 0.82 |

This may be classed as ordinary good water and should not affect iron or steel pipes in any extraordinary way.

The water on being heated in the boiler *a* circulates between the boiler and the sink cocks to insure hot water being drawn instantly when a cock is opened. The circulation is from the top of the boiler up through the flow pipe *d* and back through the return pipe *c* to become reheated in the boiler. These pipe lines are all composed of annealed brass pipe tinned both outside and inside and connected with heavy cast brass beaded fittings. A piece of 2-inch pipe 10 feet long was removed at *x* and replaced with ten short pieces of 2-inch iron pipe screwed together as shown in Fig. 2.

The temperature of the water as it flows through this pipe varies presumably from about 160° to 212°, and the supply of hot water is maintained day and night all the year around.

Owing to the fact that these iron samples were connected to brass pipes, and also because a large number of presses and other printing and book-binding machinery driven by individual electric motors are used in this building, we wired and cross-wired the pipes with copper wire as shown, connecting the ends with perfect contacts to the brass pipes at *g* and *h*. This was done under advice from electrical experts to carry any stray current around the samples and thus avoid decomposition due to litic action. It was thought this precaution would insure a corrosion that would be due to nothing but the ordinary action of the hot water on each sample, and that no sample would be favored in any way. The samples were installed March 7, 1906; were removed March 14, 1907, and were in constant service during that time.

As soon as they were removed and separated, the ends were photographed (see Fig. 3) to show the rust formation and its thickness. The velocity of the water through the samples was always low; it never was high enough to wash out or dislodge the rust, which, therefore, formed a fairly uniform lining about ⅜-inch

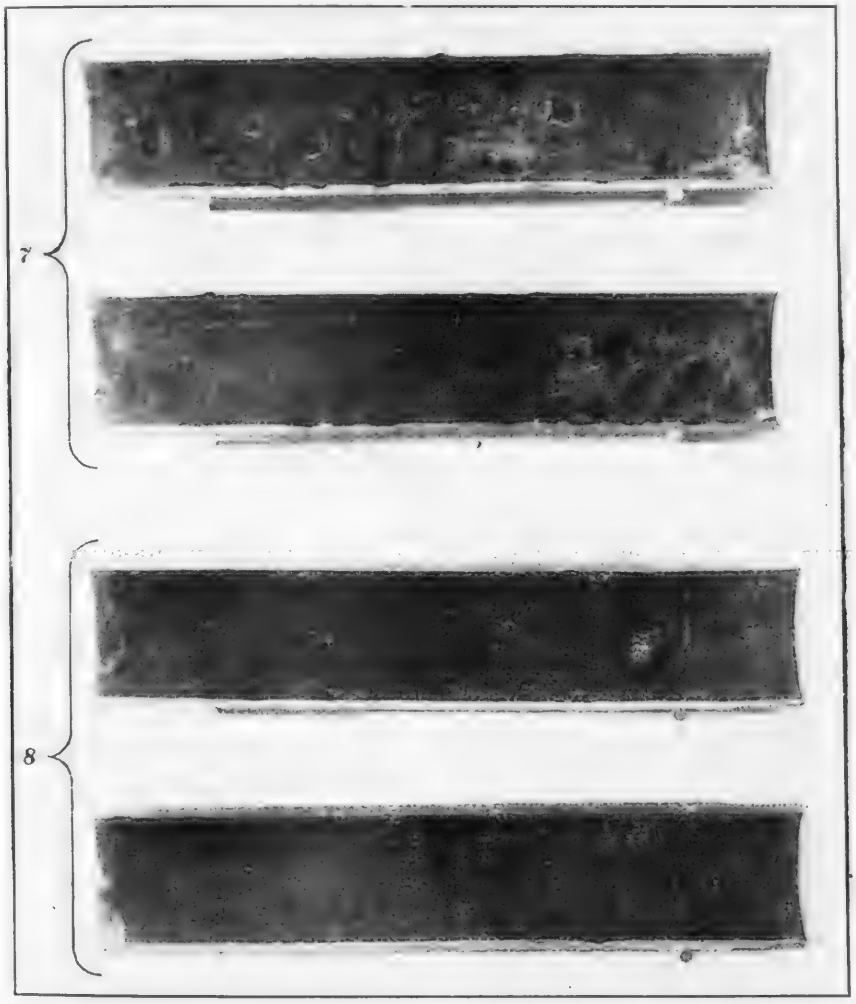



FIG. 7

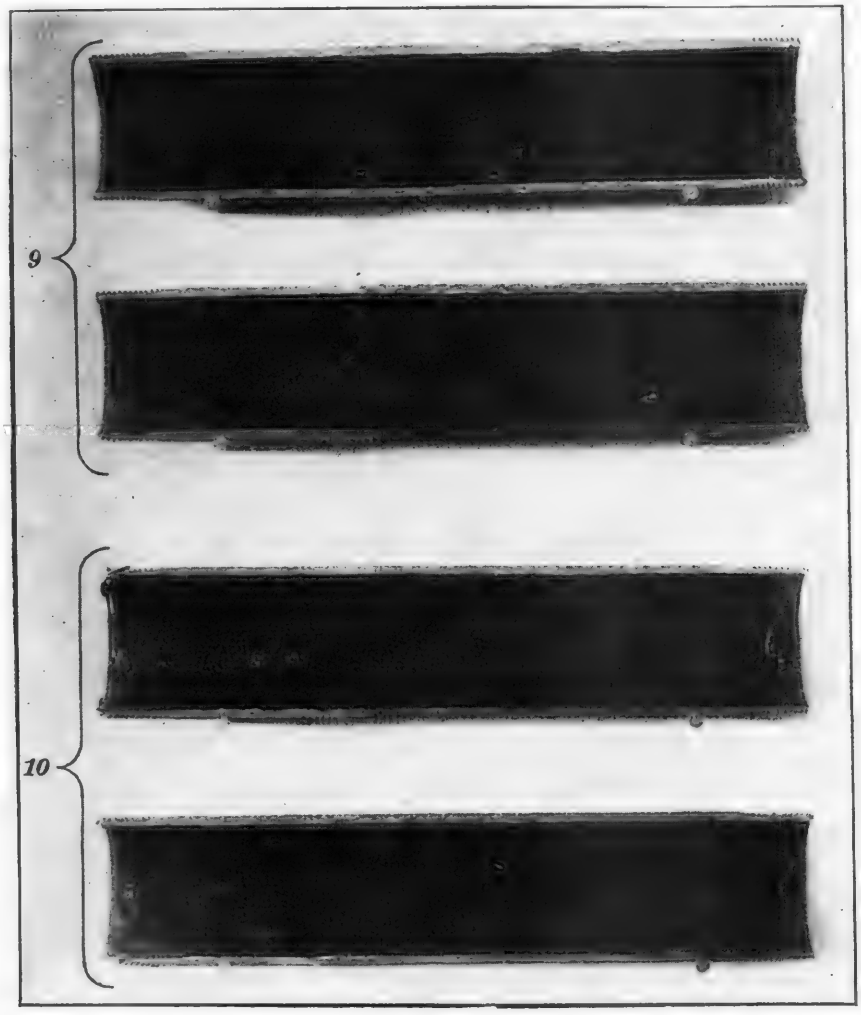



FIG. 8

thick in the black samples. The galvanized samples were not affected this way; they corroded only in spots which presumably were imperfections in the galvanizing.

Before installing the samples we weighed each one separately without the couplings, so that after the rust was all washed out and the samples weighed again the difference in weight indicated the total weight of metal lost by corrosion. Here we found that in the plain pipes 9 13-32 lbs. of wrought iron lost 20¾ ozs., while 9 11-32 lbs. of steel lost 24⅞ ozs. (The galvanized samples are not included here because the zinc coating affects their durability.)

This is where we are tempted to stop short and conclude that as the steel pipe in this test has lost more metal than the wrought-iron pipe it follows that the wrought-iron pipe is the more durable. But such a conclusion would be misleading and absurd in the extreme, because the life of a pipe depends not upon the amount of the corrosion but upon the deepest pitting. A certain pipe may lose only 1% of its weight by corrosion when it begins to leak from some pittings, while another pipe may have lost 50% of its weight by corrosion and still be perfectly tight and serviceable. Therefore, it appears evident that in order to determine the relative life of the samples it is necessary to measure the depth of the pittings and base conclusions on these measurements.

With this end in view, we sawed open each sample lengthwise; then an expert in micrometer measurements, a tool-maker accustomed to very fine work, was detailed to measure the depth of the five deepest pittings in each half, making 100 micrometer measurements. It really was only necessary to measure the deepest pitting in each piece, but to locate it by the eye was impossible. By selecting the five which appeared to be the deepest, however, we felt sure that we measured the deepest pitting in each piece.

The accompanying Table I is a record of the results of this test.

The thickness of the metal under each pitting was first measured by "Starrett" transfer calipers having sharp points; then a very delicate small inside caliper was used to just touch the points of the transfer caliper, and the distance between the points of the inside caliper was measured with a 1-inch micrometer. Each pitting was measured in the same way and by the same person. The measurements recorded here are believed to be correct to within 1-1000 of an inch.

Figs. 4, 5, 6, 7 and 8 are from photos of the samples after they were cut in halves. A close examination will show quite a difference between the corrosion of the steel and the iron.

SUMMARY

Assuming that corrosion had been continued at the rate which existed during the period of the test, then the different samples would have become corroded through at the end of the number of days given in the accompanying Table II.:

TABLE II

DURABILITY OF THE SAMPLES

Plain Pipe

| | | |
|---|---|---|
| No. 10. | Steel pipe ..... | 850.4 days |
| No. 5. | Wrought-iron pipe .. | 780.5 days |
| No. 6. | Steel pipe ..... | 780.5 days |
| No. 2. | Steel pipe ..... | 759.7 days |
| No. 9. | Wrought-iron pipe .. | 759.7 days |
| No. 1. | Wrought-iron pipe .. | 686.5 days |

Galvanized Pipe

| | | |
|---|---|---|
| No. 8. | Steel pipe ..... | 1,162.9 days |
| No. 3. | Wrought-iron pipe .. | 1,162.9 days |
| No. 7. | Wrought-iron pipe .. | 770.0 days |
| No. 4. | Steel pipe ..... | 619.3 days |

The average life of the plain steel pipe samples is 796.9 days, while the average life of the wrought-iron samples is 742.2 days, making a difference of 54.7 days in favor of steel. Therefore, a rational deduction to draw from the preceding facts is that plain steel pipe is more durable than plain wrought-iron pipe when used to convey hot water and subject only to internal corrosion.

I know that the above summary is not in perfect harmony with the opinions of many engineers and contractors, but I can only record the facts as they are found. I have brought the samples here for inspection and checking if you so desire. If any errors can be discovered either in the method of making the test, obtaining the data, or in the deduction, I will be pleased to know them.

## *Present Practice in Fan-Blast Heating**

At the annual meeting of our society held in New York in January, 1907, it was voted that a committee of five be appointed by the chair to collect data on fan-blast heating, to codify and analyze same and report through the Committee on Standards. The undersigned were appointed to serve on this committee, and beg to report as follows:

It was decided at the outset that the field covered by the above-mentioned vote is so large that the best interests of the society would be served if the committee should devote its attention at this time solely to the subject of hot-blast heaters.

Your committee has kept in mind Article IX. of the Constitution as to

*A report read at the January (1908) meeting of the American Society of Heating and Ventilating Engineers.

making any statements that would promote the interests of any individual, firm, association or corporation, and has avoided referring to the various types of heaters by their makers' or trade names.

Lists of questions and requests were drawn up and submitted to the principal manufacturers and to members of our society whose practice is known to include this class of heating.

These questions and the results of the canvass are given below.

QUESTION 1

*Please send elevations, sections, etc., showing clearly the construction of your standard heater sections.*

In reply to this question cuts or blue prints were received illustrating practically all the types of hot-blast heaters familiar to heating and ventilating engineers, including (1) those made up of vertical pipes of varying lengths connected at the top by horizontal ones, the verticals being screwed into cast-iron bases with a horizontal partition on the supply side extending to the middle, (2) those with vertical pipes connected at the top by return bends and at the bottom with a cast-iron base having a vertical partition lengthwise of the base, (3) ordinary miter coils two or four rows deep with vertical supply header and horizontal return header, (4) those with horizontal pipes expanded into vertical headers, the supply header having a horizontal partition midway of the height so that steam and return connections are on same side of heater, and (5) cast-iron heater sections with extended surface. Since all these types are fully illustrated in manufacturers' catalogues, it seems hardly necessary to reproduce the cuts in this report.

QUESTION 2

*What size and kind of pipe do you use?*

Four replies were received, as follows:

(*a*) We use National Tube Works 1-inch steel pipe exclusively.

(*b*) 1-inch steel pipe.

(*c*) We use 1-inch and 1¼-inch pipe as a rule, both the steel and wrought iron, preferably the latter.

(*d*) 1-inch steel pipe in standard sections. 1¼-inch pipe is used when specifications call for it.

QUESTION 3

*What size and kind of fittings do you use?*

Of four replies, one stated that cast-iron fittings were used, one that malleable fittings were employed, and two that extra heavy cast-iron fittings were used in the make-up of their heaters.

QUESTION 4

*What distance do you space your pipes between centers across the face of the heater, also the direction the air flows?*

Replies:

(*a*) Our pipes are spaced 2¾ inches between centers across the face of the heater and 2⅜ inches in the direction the air flows.

(*b*) 2½ inches, 2⅝ inches and 3¼ inches. Preferably 2⅝ inches.

(*c*) At present we build three spacings of heaters, 2 1-16 inches, 2⅜ inches and 2 9-16 inches. All three are for use with 1-inch pipe.

(*d*) 2⅝ inches in standard sections; 2¾ inches and 3 inches in special sections.

QUESTION 5

*How are sections connected together; by manifolds, headers or flanges, and where or when do you use the several methods?*

These replies were received:

(*a*) Nipples are screwed into the bases and into headers, and the two nipples joined by flanged unions. This is our standard method of connecting up for all purposes.

(*b*) Connect by cast-iron header with independent connections from header to each section.

(*c*) Our coil sections are connected in single sections by special header plates, also in groups of 2, 3, 4 and 5. We preferably install the coil sections with individual header plates, as the drainage of condensed water from a group of sections is much better when each section has a separate return of 24 to 30 inches dropped below the base of coil.

(*d*) One style section has header cast on end of base. When several

sections are bolted together they form a continuous header. This style of section is used principally on heating and drying work.

Another style section has independent inlet and outlet and is used principally on public and school-house work.

QUESTION 6

*What depth do you advocate making the coils in rows of pipe, for* (1) *outside air,* (2) *return air for c, d, e, f:*

(*a*) *Live steam, heating public buildings?*

(*b*) *Exhaust steam, heating public buildings?*

(*c*) *Live steam, heating factories?*

(*d*) *Exhaust steam, heating factories?*

(*e*) *Live steam for dry kilns?*

(*f*) *Exhaust steam for dry kilns?*

The replies to this question are given opposite the letters (*q*), (*r*), (*s*), (*t*), (*u*), (*v*) and (*w*).

(*q*) Depth of coils in rows of pipe as follows:

| Where Applied. | How Divided. | Outside Air. | | Circulated Air. | |
|---|---|---|---|---|---|
| | | Live Steam. | Exhaust Steam. | Live Steam. | Exhaust Steam. |
| Public Buildings | * T. C. | 8 | 8 | None. | None. |
| | Heater | 12 | 16 | | |
| | Total. | 20 | 24 | | |
| Factories | Heater only. | 20 | 24 | 16 | 20 |
| Dry Kilns | Heater only. | 20 See note below. | 24 See note below. | 16 See note below. | 20 See note below. |

* T. C. means tempering coil.

Public buildings: live steam pressure, 20 to 30 lbs.

Factories: live steam pressure, 60 to 80 lbs.

Dry kilns: live steam pressure, 60 to 80 lbs.

Exhaust steam, 5 lbs. in all cases.

NOTE.—Heaters for dry kilns vary in depth for the various classes of drying to which they are applied, many of them being eight or ten sections in depth, while others are only four sections, depending upon the temperature the material to be dried will stand and the freedom with which the material gives up its moisture.

[Four-row sections are doubtless meant.]

(*r*) Depth of heater all depends on other conditions, varies from 3 to 8 sections of four rows each.

(*s*) We do not have any standard depth for outside air or return air, nor for any coils. The depth of coil is entirely dependent upon the minimum initial temperature, the maximum increment of temperature, the velocity of air through the coils and the pressure of steam within same. In your Subdivision No. 2, Question 6, with reference to return air proposition, will state that it has been our experience that the amount of surface required for return air circulattion is but very little below that of outside air. In many types of buildings circulated air does not heat so quickly as outside air. We have found that by lack of pressure in using circulated air there is a continuous flow of air from the outside into the building through all the small cracks and crevices, and there is considerable room for argument upon this question of recirculating air for heating purposes. Inasmuch as you are probably familiar with all the facts in the case, we will say nothing further at this time regarding it, unless advised by you otherwise.

(*t*) When using live steam in coils on public work, air being taken from outside, we use 20 pipes deep in heater. When using exhaust steam, 24 pipes deep. The same applies to factory heating.

When air is returned we make

heater 16 pipes deep for live and 20 pipes deep for exhaust steam, when used for factory heating. For dry kiln work, we make heater 20 pipes deep for live steam and 24 pipes deep for exhaust steam; as a general rule, however, the conditions governing the case in question will modify the above. In some drying installations it is necessary to have a large amount or air at a low temperature, while in others a high temperature is required. The heater is proportioned accordingly.

(*u*) (a) 14 to 16 rows.
(b) 18 to 22 rows.
(c) about 16 rows
(d) 18 to 24 rows.
(e) 16 to 20 rows.
(f) 20 to 28 rows.

With return air use about 4 rows less than with live steam.

(*v*) (a) Live steam, 5 lbs. Public buildings, 16 to 20.
(a) Live steam, 40 lbs. Public buildings, 12 to 16.
(b) Exhaust steam, 5 lbs. Public buildings, 16 to 20.
*(c) Live steam, 5 lbs. Factory, 14 to 16.
*(d) Live steam, 40 lbs. Factory, 10 to 12.

The above figures of course assume that there will be standard heaters of sufficient size in wind area to accommodate all the air needed. If such is not the case, then all the figures will approach necessarily to the values in *a*.

(*w*) Have never formulated definite figures for depth of coils. Always compute each case on its own basis. Depends upon many things, such as temperature of entering air, the temperature at which it is to leave the coils, the temperature of the steam and the velocity of the air. The following figures are approximate:

| | |
|---|---|
| *a* | 14 to 20 |
| *b* | 16 to 24 |
| *c* | 8 to 14 |
| *d* | 10 to 16 |

As to *e* and *f*, higher air velocities appear permissible, greater depth of coil could be used.

*[Additional figures were given which were not clear to the committee.]

Where air-washers are installed some additional capacity must of course be installed.

QUESTION 7

*What is the ratio of free area between the pipes to the "over-all area" of a section?*

Only three definite replies were received, as follows:

(*a*) Free area between our pipes is approximately 50% of the over-all area of the sections.

(*b*) 50%.

(*c*) About 38% of over-all area.

QUESTION 8

*What is the maximum allowable velocity of air through a heater section as determined by you:*

(*a*) *For public buildings?*

(*b*) *For factory buildings?*

(*c*) *For dry kilns?*

Replies are given opposite letters (*e*), (*f*), (*g*), (*h*), (*i*), (*j*) and (*k*).

(*e*) The maximum allowable velocity of air through heater is about as follows:

(a) 800 to 1,200 feet per minute.
(b) 1,200 to 1,500 feet per minute.
(c) 1,200 to 1,500 feet per minute.

(*f*) A—1,000.
B—1,500.
C—1,600.

(*g*) We base all our velocities of air through coils upon the fan intake, as the velocity of air through the fan intake varies with different classes of buildings, according to the pressure exerted by the fan. This velocity will vary to a considerable extent. As a rule, we design the coils so as to obtain an area through them of at least 110% of the fan intake.

(*h*) For public buildings we allow a velocity of 1,400 feet; for factory and dry kiln work a velocity of 1,900 feet through heaters.

(*i*) (a) 1,000—1,200.
(b) 1,800.
(c) 1,600—1,800.

(*j*) (a) 1,000 in practice; 800 in design.
(b) 1,200 in practice; 1,000 in design.

This gives the system a chance to be forced by increasing the air velocity

above that at which it was calculated.

(*k*) (a) up to 1,000 feet per minute.
(b) up to 1,200 feet per minute.

QUESTION 9

*What temperature do you consider the air should be heated to, to give best results with a tempering coil?*

The replies were as follows:

(*a*) The temperature of air from a tempering coil should be from 55° to 65°. Owing to variations in outside temperature, the tempering coil should be made up of 8 rows of pipe, preferably 4 rows in one section and 2 sections of 2 rows each, all sections valved separately.

(*b*) 60°.

(*c*) For plenum chamber work we usually heat the tempering side of the chamber to 60° or 65° F.

(*d*) When tempering coil is used to temper air for ventilation only the air should be heated to about 75% at fan. When tempering coil is used in connection with re-heating coils, as in school-house work, etc., the air should be heated to about 50° to give good results in regulation.

(*e*) 60—70.

(*f*) If I understand the question clearly, on a zero day the air should be heated 25° or 30° by tempering coils.

(*g*) 60° F.

QUESTION 10

*How many rows of pipe do you allow for:*

(*a*) *Tempering coil?*
(*b*) *Heater coil?*

Replies:

(*a*) This is answered under No. 6 (*q*), there being 4 rows of pipe to a standard section.

(*b*) (a) Usually eight rows of pipe consisting of 2 four-row sections. (b) From 12 to 32 rows of pipe consisting of from 3 to 8 sections.

(*c*) The rows of pipe in tempering coil are from four to twelve, and the heater coils from eight to twenty-four, depending on the minimum initial temperatures and maximum increment temperature, and the steam pressure within the coils, and the velocity of air through them.

(*d*) For ventilating work we allow 12 pipes deep in tempering coils. For heating and ventilating work we usually make tempering coils 8 pipes deep.

(*e*) (a) 10—12 rows in public buildings.

(*f*) (a) 2 to 4. (b) 14 to 16.

(*g*) (a) 6 or more.
(b) 8 or more.

QUESTION 11

*Do you advocate blowing through or "drawing" through a heater? Where and why?*

Replies:

(*a*) Do not advocate either "blowing" or "drawing" through. For public buildings where continuous ventilation is wanted, either hot or tempered air can only be obtained when blowing through.

For factories and dry kilns the apparatus can be made more compact and costs less where the fan is designed to draw through the coils.

(*b*) Blow through heaters used with double duct system and when air washer or humidifier is used. For other installations usually draw through in order to discharge air directly into the ducts from fan.

(*c*) We are strongly in favor of drawing through the heater instead of blowing through; in other words, the coils should be placed preferably on the suction side of fan. This, of course, is impossible in a plenum chamber system, on account of the necessity of having two temperatures of air from the same blower.

(*d*) We prefer to draw through heater where practicable. This can be done in the majority of cases of heating and drying work. In public buildings and school-house heating it is necessary to blow through heater in order to get hot and tempered air in plenum chamber. There is no question in our minds but that drawing through heater gives a better distribution of air through same than blowing through. If every job of blow through apparatus was supplied with innumerable deflectors to guide the air to all parts of heater this style would be preferable, as we would then get the benefit of an increased air delivery from a given fan speed, due to expansion while passing through

coils. It must be borne in mind, however, that the horse-power to operate fan in the latter case would be greater due to lower temperature of air in fan.

(*e*) In regard to the question of blowing through or drawing through a heater, I would say that this depends altogether upon conditions; and the difference in volume of air handled, whether the same is heated before or after entering the fan, is not a serious question.

(*f*) Draw through as a rule, but blow through when a double duct system or mixing damper for hot and cold air is used, also when apparatus must be placed in a long, narrow room.

(*g*) "Blow through" heater should be used on a double duct system.

"Draw through" heater is probably more satisfactory to completely mix the air and give it a uniform temperature.

(*h*) There is no great choice as to whether air should be blown or drawn through coils. This is usually determined by the character of the work to be done, and the dimensions and shape of the space available. It is customary, where the situation permits, to put 30 to 40% of the heating surface in the tempering coil before the fan, and the balance beyond the fan. There is no greater objection, however, to placing the entire coil on either side of the fan, if the situation necessitates, except that where both tempered and heated air are to be distributed through the building the heating coil at least must be placed on the discharge side.

QUESTION 12

*How do you determine the maximum temperature obtainable with varying depths of heaters, velocities and steam pressures?*

Replies:

(*a*) The maximum temperature obtainable can only be determined by experiment. The following table gives fairly dependable temperatures that may be obtained, but these vary considerably above or below, being usually a little higher. The velocities are based on the average of air passing through the pipes.

Five pound Steam Pressure.

| *Sections. | 800′ Vel. | 1000′ Vel. | 1200′ Vel. | 1500′ Vel. |
|---|---|---|---|---|
| 1..... | 42 | 33 | 28 | 23 |
| 2..... | 71 | 62 | 56 | 52 |
| 3..... | 96 | 87 | 80 | 75 |
| 4..... | 119 | 108 | 101 | 93 |
| 5..... | 136 | 125 | 116 | 108 |
| 6..... | 153 | 140 | 131 | 120 |
| 7..... | 169 | 155 | 143 | 131 |
| 8..... | 183 | 166 | 154 | 141 |

*[Four-row sections are doubtless intended.]

About 10% higher temperature will be obtained with 20 lbs. pressure and 30% higher with 60 lbs. pressure.

(*b*) To determine temperature of of air after passing through a given number of coils we estimate the temperature derived from passing the air through one coil at a time. The leaving temperature of air after passing through first coil will be the entering temperature for the second coil, and so on.

(*c*) The average heating engineer makes no attempt to determine these questions for himself, but accepts the results of tests and experiments of others as tabulated by Carpenter, Munroe and other authorities.

This applies also to Questions 13 and 16.

(*d*) One heating and ventilating engineer favored us with a Chart 1, which he uses for figuring out different installations.*

Several other replies were received to Question 12, but they lacked definiteness.

(*d*) Chart II shows the practice of one manufacturer of hot-blast apparatus as to temperature rise with heaters of varying depths.

QUESTION 13

*How do you determine the heat units given off per square foot of heating surface per hour with varying initial temperatures and velocities of air, and steam pressures; also the condensation under same conditions?*

*This chart was published in THE HEATING AND VENTILATING MAGAZINE, for October, 1907, in illustration of Mr. Burt S. Harrison's article on "Charts Showing the Performance of Hot-Blast Coils."

Replies:

(*a*) We find each foot of 1-inch pipe in our standard coils will give off about 3.5 B. T. U. per degree difference temperature between entering air and steam in coils at a velocity of 1,900 feet per minute. The heat given off will vary as temperature of steam in coils and about as square root of velocity of air passing over coils. Assuming the specific capacity of air for absorbing heat as being .238 the heat units contained in the air can readily be calculated from above data, from which the condensation in coils can also be calculated.

(*b*) The heat units per square foot of heating surface per hour are obtained as follows: B. T. U. $= K\sqrt{V}(T-t)$. The factor K varies with the number of sections deep as given below:

| *Sections Deep. | K. |
|---|---|
| 1 | 3.45 |
| 2 | 3.00 |
| 3 | 2.63 |
| 4 | 2.33 |
| 5 | 2.12 |
| 6 | 1.95 |
| 7 | 1.80 |
| 8 | 1.65 |
| 9 | 1.52 |
| 10 | 1.40 |

*[Four-row sections are doubtless intended.]

V = Velocity of air through heater in feet per second based on the average.

T = Temperature of steam in heating surface.

t = Temperature of entering air.

The latent heat is about 970 B. T. U. per pound of steam. Thus dividing the heat given off per square foot per hour by the latent heat gives the pounds of steam condensed per 1 square foot per hour.

Several replies were received accompanied by blue-print charts, but data were lacking to make these of value in this report.

(*c*) Chart III. represents the practice of one of our members.*

*This chart was published in the Heating and Ventilating Magazine for October, 1907, in illustration of Mr. Burt. S. Harrison's article on "Charts Showing the Performance of Hot Blast Coils."

QUESTION 14

*What has been your experience with cast-iron pipe or other indirect radiation besides pipe coils?*

(*a*) *Has it been as effective as a heating medium?*

(*b*) *What is the comparative efficiency?*

Replies:

(*a*) Cast-iron surfaces have not proven quite as effective as pipe coils by from 12 to 20%.

(*b*) Not used extensively by us. With specially designed cast-iron radiators they are almost as efficient as indirect heater coils.

(*c*) I have not installed any of the cast iron, but have data which show that results are about the same in each under the same conditions.

(*d*) Have used pin radiation in a number of cases in schools or in buildings having a frequent air change, basing the efficiency on about 1,500 heat units per square foot per hour for primary heaters and 1,000 heat units for supplementary heaters, these with low-pressure steam.

(*e*) Indirect cast-iron pin radiators seem to give fully as high efficiency as pipe coils, but smooth cast-iron pipe does not.

Have no data, however, at hand for efficiency.

(*f*) While pipe coils are considered preferable and are ordinarily employed, I know of no objection to the use of the indirect cast-iron coils on the market, except their increased weight. Their efficiency should be the same. They can be made in various shapes, and permit of the use of extended surfaces—points which are often advantageous.

QUESTION 15

*What type of radiation do you recommend for hot-water heating?*

(*a*) *For gravity circulation?*

(*b*) *For forced circulation by pump?*

Replies:

(*a*) Either miter type pipe surface or any of the several types of cast-iron indirect radiators. Pipe surface should be designed to have as straight a flow as possib'e. This applies to either gravity or forced circulation.

(*b*) (a) Miter type coils.

(b) Special return bend heater

coils, the bases being sub-divided which prevents the water from short-circuiting.

(*c*) For gravity circulation, with hot water or steam, we recommend miter coil.

(*d*) I would say that I should select either the miter type of 1-inch wrought-iron pipe coils, or else the cast-iron blast coil.

(*e*) Hot water is rarely advisable for hot-blast work. Cast-iron radiation is usually preferred for ordinary hot-water plants, whether gravity or forced circulation. There is a widespread belief that coils, particularly if of steel, are shorter lived than cast-iron radiators.

QUESTION 16

*How do you compute the size of steam mains and returns for heaters supplied with steam at varying pressures? Also for hot-water circulation?*

Replies:

(*a*) The size of steam mains can be determined as follows:

$D = W \div 4\ P$. This covers a velocity of 80 feet per second.

D = Diameter pipe in inches.

W = Weight of condensation per hour.

P = Absolute steam pressure in pounds per square inch.

The returns are usually made 60% of the area of the main for gravity flow.

For hot water, gravity flow, the mains should be proportioned to the amount of water to be circulated, which is anywhere from 1 to 3 gallons per square foot of surface per hour, depending on the velocity of the air and its initial temperature.

For forced circulation the mains are proportioned according to the pressure and the volume of water to be circulated. The velocity of the water is usually calculated at from 5 to 12 feet per second.

(*b*) Assume a certain velocity through the heater pipe, depending upon the steam pressure available. For low-pressure live or exhaust steam we assume a velocity of 5,000 feet per minute through the main pipe and add 50% to this area for the separate pipes leading to the independent sections. For gravity return connections we assume a velocity of 4 feet per second through the piping.

(*c*) At present am taking sizes from tables in Kent, Pages 541 and 543.

(*d*) With high-pressure steam, say 60 pounds or over, these sizes have proved satisfactory for runs up to a couple of hundred feet.

| | | | | | |
|---|---|---|---|---|---|
| 1¼ | inch up to | 1,000 | lineal feet | 1-inch | pipe heater. |
| 1½ | inch " | 2,000 | " | " | " |
| 2 | -inch " | 3,000 | " | " | " |
| 2½ | inch " | 4,000 | " | " | " |
| 3 | -inch " | 5,000 | " | " | " |

For exhaust steam supply connections 100 feet run these sizes are recommended:

| Dia. Pipe. | Lineal feet of 1-inch Pipe. |
|---|---|
| 2½-inch | 1,000 |
| 3 -inch | 1,500 |
| 3½-inch | 2,100 |
| 4 -inch | 2,700 |
| 5 -inch | 5,100 |
| 6 -inch | 8,100 |
| 7 -inch | 12,000 |
| 8 -inch | 18,000 |
| 10 -inch | 30,000 |

As to returns trapped to an open tank, we recommend, when there is a good drop from heater to trap:

| | | | | |
|---|---|---|---|---|
| For 2 | -in. supply | use 1 | -in. | return. |
| 2½ | -in. " | 1¼ | -in. | " |
| 3 | -in. " | 1¼ | -in. | " |
| 4 | -in. " | 1½ | -in. | " |
| 5 | -in. " | 2 | -in. | " |
| 6 | -in. " | 2 | -in. | " |
| 7 | -in. " | 2½ | -in. | " |
| 8 | -in. " | 2½ | -in. | " |
| 10 | -in. " | 2½ -3 | -in. | " |

These sizes provide for blowing out the heater pipes to get rid of the air and are ample for the condensation.

QUESTION 17

*Do you regularly make provision for the removal of air from the radiation? If so, where and under what conditions of operation?*

Replies:

(*a*) With some types of heating apparatus it is necessary, and with others unnecessary, to make provision for the removal of air. It also makes a difference how the condensation is disposed of, whether or not air valves are necessary.

(*b*) Yes. Use either pet cocks or automatic air valves on each heater coil.

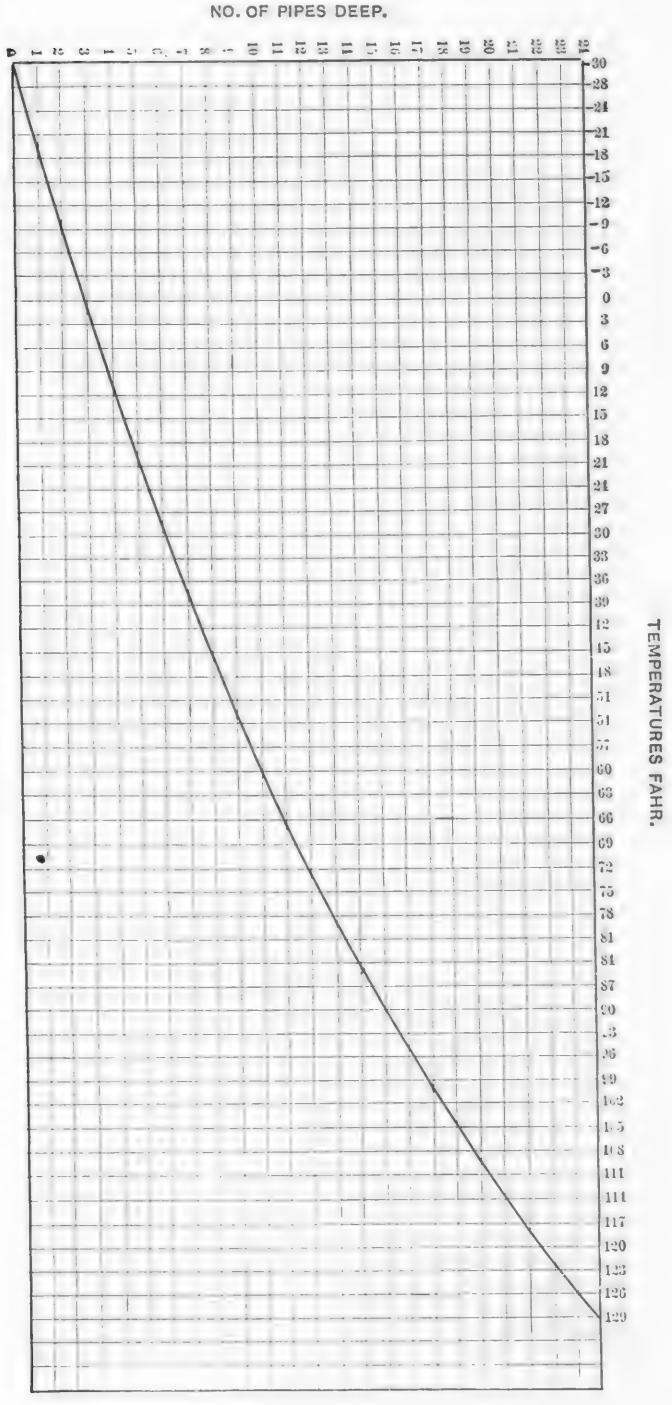



Chart II.—Showing temperature rise for heaters of various depths made up of 1-inch pipes spaced $2\frac{1}{8}$ inch centers. Steam at atmospheric pressure.
Air Velocity 1,200 feet per minute. Initial temperature minus 30° F.

(*c*) We always make regular provision for the removal of air from blast heaters under all conditions of service.

(*d*) In regard to removal of air from blast coils, I should place the air valve on the condensation return header, or base, in the case of miter type of coils, and in the same location for cast-iron blast coils.

(*e*) We do not regularly make any provision for the removal of air from our coils. In the base is a partition which divides it into two sections, transversely. That is, two sections extend the whole length of the base; on the steam inlet side a hole is tapped on the outer end, which is attached to a bleeder header, and this is looped into the main drip line. The water seal is only intended to be sufficient to overbalance the column of air in the pipes. Any condensation which collects on the steam side is thus drained into this loop and then into the main line. The circulation of steam is always over through pipes to the drip side of the base, and we never have any difficulty on account of air binding where the steam and drip connections leading to and from the heater are properly made. When specifications call for air valves we attach them to the drip side of the base on the end opposite the steam and drip connections.

(*f*) I believe that provision should be made for removing the air, care being taken to place the air vents at points where the air will collect.

In factory work I believe it is well to allow the steam to blow through the heater freely for about five minutes when starting up each morning.

(*g*) Provision should always be made for air removal from radiation, preferably at back end of heater base. It is well to have some pet cocks in addition.

QUESTION 18

*Do you consider air valves either a necessary adjunct or a means of increasing the efficiency of the type of radiation you make?*

Replies:

(*a*) We do not consider air valves a necessary adjunct or a means of increasing the efficiency of our radiation.

(*b*) One of the above is a necessity, as the coils are full of air when steam is first turned on, and there is no other way of removing the air except through either the air valves or pet cocks.

(*c*) We consider air valves very necessary in the use of heater sections which do not have a vacuum system installed in connection therewith.

QUESTION 19

*Do you make any addition to or deduction from the amount of radiation, as commonly determined by the rules or formulæ you employ, if any one of the several "Vacuum Systems" is attached to the heater?*

Replies:

(*a*) What advantage, if any, is gained by attaching a "vacuum system" to the heater has never been definitely fixed.

(*b*) No, we do not.

(*c*) We do not make any additions or deductions from the amount of heater coils when used in connection with any of the vacuum systems.

(*d*) As to my method of figuring blast work where vacuum systems are used, I would say that I figure the job exactly as though it were to operate under 5-lb. steam pressure, with 1-lb. loss in circulation. The resulting pipe sizes will be exactly right for the steam operating under vacuum.

(*e*) I do not, as I believe the thorough removal of air more than offsets the slight gain in temperature of the heating surface due to the somewhat higher steam pressure carried with ordinary low-pressure systems.

(*f*) I do not as a rule make any material reduction in radiation when a vacuum system is used. In view of the fact, however, that such systems prevent air binding, insure quick circulation and maintain each square foot of surface at its highest efficiency, it would seem proper to figure a little closer, or to cut down somewhat the usual margin of safety. Such systems being usually installed to utilize steam of atmospheric pressure, thus permitting the use of exhaust steam without back pressure, there is a slight reduction in working temperatures, which should not be lost sight of.

**Summary**

The above gives the results of your committee's labors in collecting and codifying data on hot-blast heaters.

As to analyzing same as mentioned in the vote appointing this committee, it may be said that the replies to most of the questions are self-explanatory. It is disappointing that a number of the replies were inadequate to meet the requirements of your committee. A number left it uncertain as to whether the velocity of air through the heater was to be based on the average volume, the volume at entrance or the volume at exit. If nothing is stated to the contrary one would infer that the velocity based on the average volume of air passing through the heater is the one intended to be used in connection with the rules or charts given.

Perhaps Questions 12 and 13 are the ones of most interest to members of this society.

Taking up first the question of maximum temperature obtainable with varying depths of heaters, Reply (*a*) to Question 12 gives a table for 5 pounds steam pressure, which for a heater of four 4-row sections with average velocity between the pipes of 1,200 feet, entering air 0°, shows the final temperature to be 101°.

Under Reply (*c*), Chart I is given, which for the same heater and conditions applies as follows:* On lower line at right about half-way between 220° and 240° is the difference in temperature between the steam at 5 pounds and the air entering at 0° F. Follow up this line to the diagonal marked 1,200 feet velocity, and at the intersection carry a line across horizontally until it intersects the 16-row diagonal line at the left of the chart. Dropping a vertical line from this last intersection to the horizontal base line at the left shows the final temperature sought to be about 116°.

Of course this process may be reversed—that is, knowing the final temperature desired, a vertical may be carried up from this line and the intersection with the horizontal carried over from the intersection of the vertical steam pressure line with the diagonal velocity line selected will give the number of rows of pipe required.

Chart II., accompanying Reply (*d*), shows the temperature rise with steam at atmospheric pressure in the coils, air velocity 1,200 feet and 16-row heater to be 109°.

The 0° line intersects the curve opposite the 3-row point. Add 16 then opposite the 19-row point note intersection with curve, and opposite this intersection is the 109° sought.

As to Question 13, in regard to determining the heat given off per square foot of heating surface under varying conditions, Reply (*b*) gives a formula which for a 16-row heater, 20 feet velocity per second, steam temperature 228°, entering air 0° shows B. T. U. per square foot per hour to be

$2.33 \sqrt{20} (228—0)$ which is equal to 2,370 B. T. U.

Reply (*a*) gives a heat emission of approximately 10.5 B. T. U. per square foot per hour per degree difference in temperature between steam and entering air, velocity of air 1,900 feet. This with 5 pounds steam pressure and 0° air is equivalent to $228° \times 10.5 =$ approximately 2,400 B. T. U.

Reply (*b*) for these conditions works out as follows for a 16-row heater 5 pounds steam 1,900 feet per minute velocity: B. T. U. $= 2.12 \sqrt{31.7} (228° —0°) =$ approximately 2,720 B. T. U.

Chart III., sent in with Reply (*c*), gives for 1,900 feet velocity through a 20-row heater approximately 10.5 B. T. U. given off per square foot of heating surface per hour per degree difference in temperature between steam in coils and air entering heater, hence in this corresponds with reply (*a*).*

Certain deductions of value might perhaps be drawn from the replies secured to a number of the questions, but as a rule, the replies were insuf-

*The method of using this chart was explained in connection with the article on the subject in THE HEATING AND VENTILATING MAGAZINE, for October, 1907.

*The method of using this chart was explained in connection with the article on the subject in THE HEATING AND VENTILATING MAGAZINE, for October, 1907.

ficient in number or were so incomplete as to hardly warrant your committee drawing any definite conclusions therefrom. Much more could be accomplished if replies greater in number and more in detail could be secured from members.

It would be of interest if the replies had contained more information as to the experiments or authority on which the various rules or formulæ stated were based.

It is hoped, however, that this report, incomplete though it is, will serve to show something of the practice in this class of work and will stimulate a greater interest in the so-called "hot-blast" method of heating.

WM. G. SNOW, Chairman,
R. C. CARPENTER,
J. H. KINEALY,
F. R. STILL,
J. H. BRADY.
Committee on Hot-blast Heating.

## *Fuel Economy**

BY L. J. WING

L. J. WING

ON account of the steadily increasing cost of all kinds of fuel, I deem the question of fuel economy as the most important subject before this association composed of heating and ventilating engineers and contractors for heating and power plants.

The reports and papers that have been read on "saving of heat units by the use of the various types of radiators and the various systems of piping, etc.," have been very interesting, and undoubtedly of assistance to the members of the association.

I ask the question: Which is the most important, the saving of the small difference of heat units delivered by the different types of radiators or systems of piping, etc., or the producing of the greatest number of heat units from the fuel burned?

It is a well-known fact that well equipped and properly run boiler plants will give from 25 to 50% more steam per pound of coal than the commonly equipped and carelessly run plant will.

I think it is the duty of heating, ventilating and consulting engineers to use their knowledge and influence to teach acting engineers and firemen the art of saving fuel, and also persuade owners to properly equip their boiler plants and insist upon their employees giving the best possible care and attention to operating the plant to get the greatest efficiency and economy possible.

On account of the enormous consumption of coal, oil and other fuels in this and other countries, it is only a question of time when power derived from steam will be very costly: therefore, any improvement in combustion is of benefit to mankind as well as to owners of large or small power plants.

Mr. J. C. Jurgensen, a well known practical and consulting engineer, writes on this subject as follows:

"The boilers are that part of a plant where the most money can be saved or squandered. There are every day opportunities present in the fire room which when grasped by the intelligent engineer or fireman soon will single him out as a man who will be considered."

Now what is the best way to operate a boiler plant to deliver the greatest amount of actual power from a pound of any given kind or quality of coal?

I trust that our members who have had experience in this line will give us practical information on this subject.

From my experience in this matter I think the questions of grates and draft are the two most important points.

*Read at the January, 1908, meeting of the American Society of Heating and Ventilating Engineers.

The grates should be made so as to give sufficient air space and yet not allow loss or waste of coal by falling through the opening of the grate. This is particularly necessary when burning small anthracite.

I have seen cases where the loss from this cause was from 10 to 15%.

The amount and temperature of the air supply is, in my opinion, the leading feature in fuel economy.

I find that a large number of architects and consulting engineers still hold that a tall chimney or an induced draft is the best and most economical system.

I do not agree with them. A strong draft by a tall chimney necessarily requires a great amount of heat in the stack to make the draft. The heat going out of the stack is an absolute waste.

On tests made in a large plant here in this city having a system of forced draft with a stack nearly 300 feet high showed the gases 64° lower when the blowers were in use than with the natural draft, while the saving in fuel was over 18% and the boilers gave 30% additional power, at the same time the grates and tubes were kept in better condition than with natural draft.

With a strong natural or induced draft making a vacuum in fire and combustion chambers, the tendency of the air or gases is to take the most direct route from inlet to outlet, leaving a large portion of the shell or tubes out of the current, and, therefore, all parts are not heated equally, which is not good for any type of boiler.

Another objection is the fact that when the fire door is opened to feed or clean the fires a large amount of cold air is drawn in which strikes the parts of the boiler subjected to the most intense heat, causing great unequal contraction and expansion, which causes great injury to the shell and tubes and greatly reducing the furnace temperature and causes the steam pressure to drop.

On this point I again quote Mr. Jurgensen:

"A very important and partly avoidable loss is due to excess of air supply and too high a temperature of escaping gases.

"There is a good deal of uncertainty as to the excess of air needed; it is generally agreed that with ordinary chimney draft 100% additional is needed, or 23.2 lbs., and with mechanical draft giving moderate pressure in the ash pit 30%, or 17.4 lbs. For various reasons, with mechanical draft the excess may with profit be further reduced; the actual excess for a given fuel under the many different conditions possible can only be found by intelligent experiment. As before stated, with chimney draft the air supplied is seldom less than 100 per cent. more than the actual amount needed.

"The weight of the chimney gases discharged per pound of carbon burned when 100% excess of air is used is $11.6 \times 2 = 23.2$ lbs.; adding the weight of the carbon it is 34.2 lbs. To heat this enormous weight of gas discharged by the chimney to a much higher temperature than necessary means a loss in money value that would stagger most plant owners if it was thoroughly appreciated."

Practical tests on many boilers have shown that with a blower and a small per cent. of good dry steam thoroughly mixed with the air under the ashpit, with a steady even pressure, keeps the grates in good order, gives more perfect combustion, leaving less ashes and clinkers, than with the hand dampers closed to that point that, when the fire door is opened, there is only a slight inward draft, but no gases coming out. This will give a clear white flame, and being a plenum or slight pressure in the fire and combustion chambers the shell or tubes will be evenly heated, the whole length giving more steam and yet keep the boiler in much better condition, while the saving in cost of fuel is from 10% to 50%.

I also find it a good plan to carry a pipe or duct from the blower to the top of the boiler, and draw the hot air down and burn it, as it saves fuel and cools the boiler room.

THE HEATING AND VENTILATING MAGAZINE

Vol. 5 January, 1908 No. 1

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ONE result of the recent depression in business is the opportunity it has offered engineers generally to stop and reflect on the progress of their profession. The long-delayed test or the half-completed calculations may now be taken up and pushed through to a finish, to say nothing of a brushing up of some part of one's technical knowledge and the gleaning of the latest practice as presented from month to month in the trade press. Not only the current issues of technical periodicals but the back numbers as well are receiving an attention and perusal such as, perhaps, they have never previously enjoyed, and their contents, too, were never more interesting than they are at the present time, due to the same cause—the leisure afforded the most intelligent and successful men in their respective lines to contribute of their knowledge and experience to the columns of the trade press.

The circumstances referred to are not without interest to advertisers who now have an extraordinary opportunity for gaining the attention of prospective customers. An active and persistent publicity at this time is one of the surest guarantees of a generous share in future business.

SOME indication of the deepening interest in the technical side of heating and ventilation is shown in the marked increase in membership during 1907 reported by The American Society of Heating and Ventilating Engineers. The net gain, 44, marks the past year as a banner one and puts the society on a firmer footing numerically than it has ever been.

The annual meeting, held this month in New York, contained several noteworthy papers, while, among its reports, those of the committee on fan-blast heating and of the committee on the collection of data on hot water heating, will, we think, fulfill the anticipations of those who worked for the committees' appointment. It will be noted that the fan-blast committee incorporated in its report two charts on this subject prepared by Mr. Burt S. Harrison and published in THE HEATING AND VENTILATING MAGAZINE for October, 1907.

OF the professional papers read before the society, that of Mr. T. N. Thomson on the "Corrosion of Wrought Iron and Soft Steel Pipes," published on another page of this issue, is, in many respects, a sequel to Mr. Thomson's former paper on the "Power Required to Thread, Twist and Split Wrought Iron and Mild Steel Pipe," to which should be added a third paper on the same general subject, that of Prof. Reid T. Stewart on the "Collapsing Pressures of Bessemer Steel Lap-Welded Tubes."

Mr. Thomson's previous paper was published in THE HEATING AND VENTILATING MAGAZINE for January, 1906, and Prof. Stewart's paper appeared in our May, 1906, issue. The trio form a defense of soft steel pipe as compared with wrought-iron pipe that has gone far to remove a deep-seated prejudice against the use of this grade of steel pipe for heating and power work.

AN INTERESTING suggestion is going the rounds of the Western papers that beats the scheme of the Kansas City negro who secured hot water for heating purposes through the friction of a wheel revolving in the tank containing the water and operated by a gas engine. The new scheme is attributed to Prof. H. W. Wiley, the government's chemist in chief, who says, "Make the wind heat your houses. Do it by means of windmills. No such windmills as we have now, but scientifically-constructed windmills. Properly utilized, an ordinary windmill with eight-foot sails would be capable of keeping the ordinary dwelling at a temperature of 70° F. all winter. Electric heaters suitable for the purpose are already on the market. The winds which hitherto have been permitted to go almost entirely to waste, will be a source of heat, light and power for ages after the coal fields and oil wells of the world are exhausted."

RECENT efforts to abate the smoke nuisance in American cities leads a writer in the Chicago *Post* to sum up what he considers the reasons for the improper design, construction and installation of furnaces, resulting in imperfect combustion of fuel. They are stated as:

Due to lack of knowledge of the requirements of a good boiler.

General neglect of the architects or purchaser to provide ample space for boiler and appurtenances.

To the fact that the purchaser does not follow the recommendations of a competent engineer, generally due to a desire to save money on first cost of apparatus.

Due to the ability of the salesman to sell his apparatus, even though it is not best adapted to the conditions.

The desire of the manufacturer to design his boiler for the least cost, based on a given amount of heating surface.

The desire of the manufacturer to adopt a standard boiler setting and boiler for a given rating for all conditions, and thereby save engineering expense and drawings which would otherwise be necessary in making changes required for varying conditions.

The time and energy required to overcome the resistance of the public in assimilating and appreciating facts.

Having knowledge of the subject, but ignoring civic duty.

THE following are the newly-elected officers for 1908 of the American Society of Heating and Ventilating Engineers, as announced on the opening night of the Society's meeting, January 21st:

President, James Mackay, Chicago; first vice-president, Jas. D. Hoffman, Lafayette, Ind.; second vice-president, B. F. Stangland, New York; secretary, W. M. Mackay, New York; treasurer, U. G. Scollay, Brooklyn, N. Y.; directors. C. B. J. Snyder, New York; R. C. Carpenter, Ithaca, N. Y.; Frank K. Chew, New York; August Kehm, Chicago; and John F. Hale, Chicago.

## The Weather During December

Reports from various parts of the country show the weather for December, 1907, to have been unusually mild. In New York and Chicago the mean temperature for the month was 4° above the normal.

NEW YORK

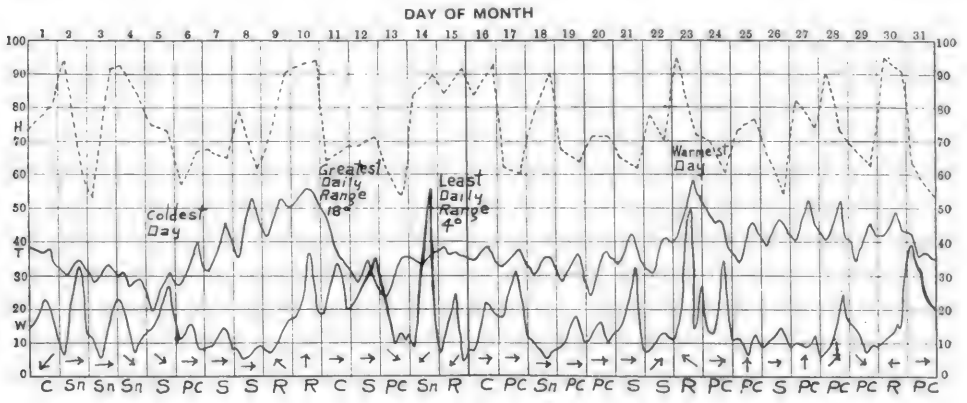
In New York, the highest temperature recorded was 58° on the 23d, and the lowest, 19°, on the 5th. The greatest daily range was 18° on the 11th and the least daily range, 4° on the 15th. The mean temperature for the month was 38°, 4° above the mean of this month for 37 years. There was 3.91 inches of rain, 1.35 inches falling on the 14th and 15th. There was a snowfall during the month of 4.4 inches. The prevailing direction of the wind was west and the total movement 10,419 miles; average hourly velocity, 14.0 miles; maximum velocity for 5 minutes, 56 miles from the northeast on the 14th. There were 7 clear days, 13 days partly cloudy, 11 cloudy and 10 rainy.

PITTSBURG

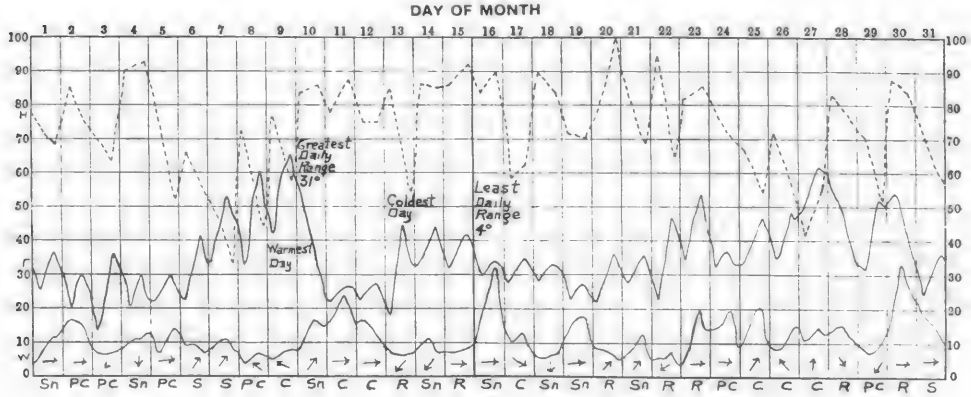
In Pittsburg, the highest temperature was 64° on the 9th and the lowest, 18° on the 13th. The greatest daily range was 31° on the 10th. The mean temperature for the month was 35°, which is 1° above the normal temperature for 37 years. The total rainfall for the month was 3.03 inches, and the total snowfall, 3.4 inches. The greatest rainfall in any one day was 1.08 inches on the 13th and 14th; prevailing direction of the wind, west. There were 15 rainy days, 3 clear days, 9 days partly cloudy and 19 cloudy.

CHICAGO

In Chicago the mercury touched 58° on the 27th and 19° on the 31st. The greatest daily range was 21° on the 9th, and the least daily range, 4° on the 13th. The mean temperature for the month was


DAY OF MONTH
Coldest Day
Greatest Daily Range 18°
Least Daily Range 4°
Warmest Day
C Sn Sn Sn S Pc S S R R C S Pc Sn R C Pc Sn Pc Pc S S R Pc Pc S Pc Pc Pc R Pc

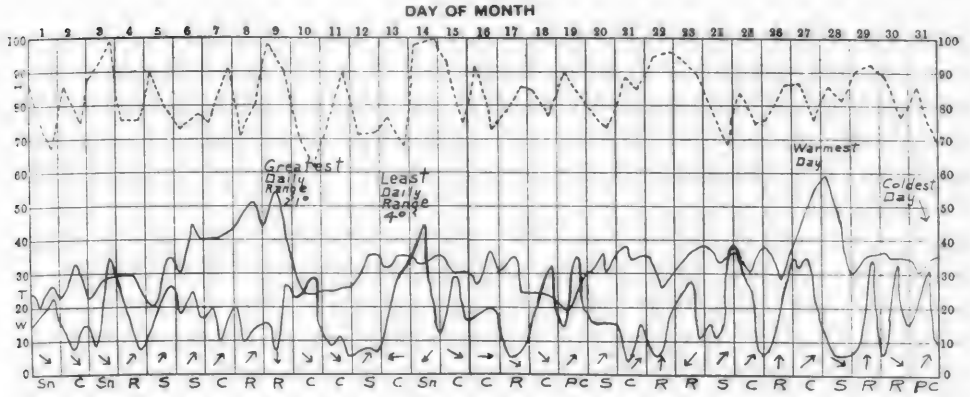
RECORD OF WEATHER IN NEW YORK FOR DECEMBER, 1907


DAY OF MONTH
Greatest Daily Range 31°
Warmest Day
Coldest Day
Least Daily Range 4°
Sn Pc Pc Sn Pc S S Pc C Sn C C R Sn R Sn C Sn Sn R Sn R R Pc C C C R Pc R S

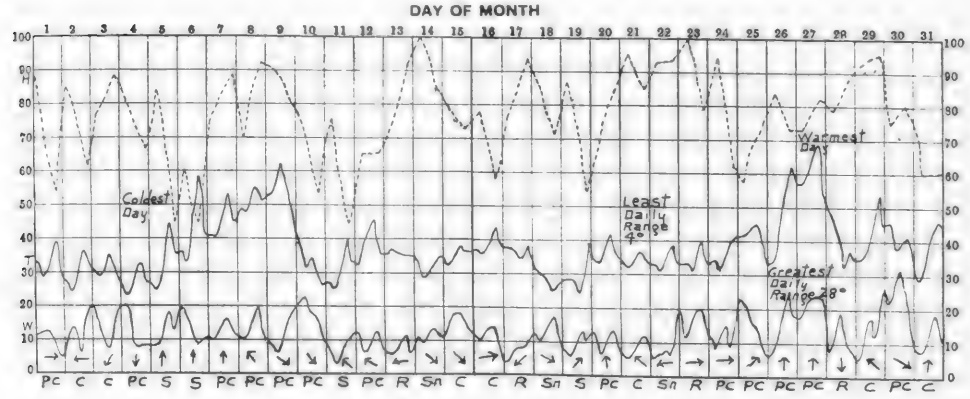
RECORD OF WEATHER IN PITTSBURG FOR DECEMBER, 1907

Plotted from records especially compiled for THE HEATING AND VENTILATING MAGAZINE, by the United States Weather Bureau.

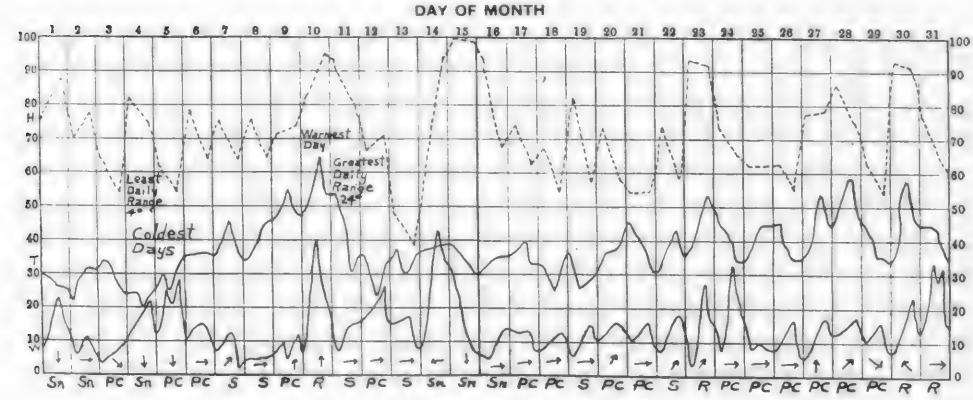
Upper line indicates temperature in degrees Fahr.
Dotted line indicates relative humidity in percentage from readings taken at 8 a. m. and 8 p. m.
Lower line indicates velocity of wind in miles per hour
Arrows fly with prevailing direction of wind
S—Clear. PC—Partly Cloudy. C—Cloudy. R—Rain




RECORD OF WEATHER IN CHICAGO FOR DECEMBER, 1907




RECORD OF WEATHER IN ST. LOUIS FOR DECEMBER, 1907




RECORD OF WEATHER IN BOSTON FOR DECEMBER, 1907

Plotted from records especially compiled for THE HEATING AND VENTILATING MAGAZINE, by the United States Weather Bureau.

Upper line indicates temperature in degrees Fahr.
Dotted line indicates relative humidity in percentage from readings taken at 8 a. m. and 8 p. m.
Lower line indicates velocity of wind in miles per hour
Arrows fly with prevailing direction of wind.
S—Clear. PC—Partly Cloudy. C—Cloudy. R—Rain.

33°, 4° above the normal temperature for 37 years. During the month 2.73 inches of rain fell and 12.8 inches of snow. The greatest amount of rain in any one day was 0.99 inches on the 13th and 14th; prevailing direction of the wind, southwest; total movement, 11,559 miles; average hourly velocity, 16 miles; maximum velocity for 5 minutes, 42 miles from the northeast on the 14th. There were 6 clear days, 3 partly cloudy, 22 cloudy and 13 rainy.

ST. LOUIS

The highest temperature recorded for the month was 69° on the 27th and the lowest, 23° on the 4th. The greatest daily range was 28° on the 26th, and the least daily range, 4° on the 21st. The mean temperature for the month was 38°, 2° above the average for 35 years. The total rainfall was 2.06 inches and the total snowfall, 6.5 inches. The greatest rainfall in any one day occurred on the 22d and 23d, when 1.13 inches were recorded. The average rainfall for 27 years is 2.25 inches. The prevailing direction of the wind was south; total movement, 8,736 miles; average hourly velocity, 11.7 miles; maximum velocity for 5 minutes, 42 miles per hour from the west on the 30th. There were 5 clear days, 14 partly cloudy, 12 cloudy and 9 rainy.

BOSTON

The highest temperature recorded for the month was 64° on the 10th and the lowest, 20° on the 5th. The greatest daily range was 24° on the 11th and the least daily range, 4° on the 4th. The mean temperature for the month was 37°, 5° above the average for 37 years. During the month 4.31 inches of rain fell and 7.0 inches of snow. The greatest amount of rain in any one day was 1.54 on the 10th. The prevailing direction of the wind was west; total movement, 8,099 miles; average hourly velocity, 12.1 miles; maximum velocity for 5 minutes, 43 miles from the east on the 14th. There were 7 clear days, 15 partly cloudy, 9 cloudy and 11 rainy.

## The Abuse of Valves

"Probably few fittings are more abused than globe or gate valves by the careless workman while putting them in place," said A. H. Hecker, of the William Powell Valve Company, in the course of a recent address before the Modern Science Club of Brooklyn on the subject of "Valves and Valve Construction." "Hundreds are ruined," he continued, "by merely screwing them up. They should never be wrenched by the end opposite the joint that is being made, but the wrench should be applied directly to the end to be screwed up; otherwise the shell or walls of the casting are sure to be twisted or strained more or less and the valve seat made untrue, then, when the pressure is turned on, the valve leaks, and the manufacturer gets all the blame.

"Again, a globe or gate valve should never be gripped in a vise while screwing up the pipe, as no matter how strong the valve may be, damage is sure to occur. Another source of injury is the practice of sousing the screw ends with red lead or cement before applying the pipe; the consequence is, the cement is shoved forward into the valve, runs on to the seat or disk, and before the fluids can pass through the valve and wash them thoroughly out, the cement hardens, and again the manufacturer is blamed because the valve 'leaked from the start.'

"No cement should ever be put in the screw of the valve, but always on the male screw of the pipe, and then very sparingly. It is better for brass valves not to use cement at all, as a few drops of oil on the pipe thread will insure a better joint. After a job is completed the valve disk should never be screwed down, but left wide open until all the pipe chips, iron rust, etc., are blown out thoroughly, as many a valve has been ruined by screwing the disk down on a small particle of rust or iron chip, which is driven into the metal of the seat of the valve, causing a leak 'from the start,' for which the manufacturer is also blamed. In the use of valves they should never be allowed to wear without occasional examination.

"Owing to the steadily increasing pressure in steam plants, it has become necessary to use a good deal better material in the manufacture of valves than was formerly used and to make them heavier than was necessary under the old days of low pressure. For instance, the government has adopted the following formula as a standard valve mixture: 87 copper, 7 tin, 4 spelter, 2 lead. The ordinary commercial mixture for valves is 86 copper, 2 tin, 5 spelter, 7 lead. Another cheaper one is 80 copper, 7 lead, 13 spelter. These, of course, are very much cheaper mixtures, figuring $22.20 per hundred for the cheaper one and $24.10 for the better, as against $26.17 for our mixture, which is used in all our high-grade valves. There is still, however, I regret to say, a demand for cheap valves, and as long as this demand continues there will be manufacturers to supply it."

## Data For a Heating Engineer's Handbook.

EDITOR HEATING AND VENTILATING MAGAZINE:

I was gratified to note the publication in your December issue of certain tables intended for a Heating Engineer's Handbook. On examining same closely, however, they appear misleading.

Rule 2, Page 1. The words "per degree difference" should be omitted.

Table 1, Page 2. The figures given are not per degree difference of temperature as stated, but for the varying degrees given in the first column. They are, furthermore, per square foot of exposed surface, which important fact is not stated.

Table 2, Page 3, is also wrongly headed, the figures not being per degree difference of temperature as stated, but for varying steam and room temperatures. The sub-heading is not "degrees difference of temperature" "but "degrees temperature t." Both should be changed.

Table 3, at bottom of page. The factor 0.23 represents the heat units required to heat one pound of air one degree, and not one cubic foot. Table 3 is practically T—t ÷ 50. It is more customary to use 55 instead of 50 for the number of cubic feet of air heated one degree by one heat unit.

Table 4 is inconsistent with previous tables. Table 1 indicates that one square foot of glass gives off about one heat unit per hour per degree difference of temperature, the usually accepted rate. This heat loss will cool 55 cubic feet of air one degree instead of 75. The statement that 10, 15 and 20 square feet of wall of varying thicknesses are equal in heat radiating power to one square foot of glass surface, is not only inconsistent with Wolff's experiments, but does not agree with Table 1, which confirms the generally accepted figure of 4 to 1.

The general statement is made that where coils are to be used instead of cast iron radiators 85% of the surface found by the previous calculation will answer. There is much more difference than this. Furthermore, there is more than 15% variation in different shapes and sizes of radiators, comparing single-column with four-column, for instance, and 15-in. height with 45-in. Such differences are not considered in the formula you publish.

I suggest that proper corrections be made in your next issue.

WILLIAM H. BRYAN,
Consulting Engineer.

St. Louis, Mo., Jan. 6, 1908.

## AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS

NEW MEMBERS

Frank E. Baker, Iowa Mfg. Company, Oskaloosa, Iowa.

Francis N. Bard, Norwall Mfg. Company, Chicago.

John G. Beazley, Western Electric Company, Chicago.

Albert C. Burdick, Kellogg-Mackay-Cameron Company, Seattle, Wash.

P. C. Doherty, Poughkeepsie, N. Y.

George D. Farnham, Board of Education, New York City.

Howard T. Gates, McCrum-Howell Company, New York.

William A. Green, F. W. Lamb Company, Chicago.

Laurent Lowenberg, Reliance Engineering Company, Cincinnati.

Frederick F. MacNichol, F. F. MacNichol & Co., Oshkosh, Wis.

Frederick R. Perkins, American Radiator Company, Dallas, Texas.

Arthur G. Pettelkow, United States Heater Company, Omaha, Neb.

Charles S. Prizer, Abram Cox Stove Company, Philadelphia, Pa.

Daniel J. Rice, New York.

Loring G. Robbins, Robbins, Gamwell & Co., Pittsfield, Mass.

George T. Simpson, St. Paul, Minn.

James J. Tait, Spencer Plumbing and Heating Company, San Francisco.

Hiram B. Van Buren, Eureka Heating and Lighting Company, Battle Creek, Mich.

Charles E. Warsop, Automatic Heating Company, Indianapolis, Ind.

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Joseph W. Curtis, McCrum-Howell Company, Norwich, Conn.

George L. Greenman, McCrum-Howell Company, New York.

Joseph J. Miller, Jenkins Brothers, Chicago, Ill.

Vincent D. Rossman, Modern Heating Company, St. Louis, Mo.

JUNIOR MEMBERS

Daniel Hogan, Elliott & Barey Engineering Company, St. Louis, Mo.

Roy E. Lynd, Richardson & Boynton, Dover, N. J.

Benjamin Natkin, Webster, Webster & Co., Kansas City, Mo.

George W. Nichols, Milwaukee Central Heating Company, Milwaukee, Wis.

Samuel C. Parter, Arthur McGonagle Company, New York.

Perry W. Rathbun, United States Supply Company, Omaha, Neb.

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The January meeting of the Illinois Chapter was held Jan. 13, in the rooms of the Western Society of Engineers, Chicago, Ill. J. J. Houlihan, chief inspector of steam boilers and steam plants of the city of Chicago, was the principal speaker.

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In a letter addressed to members of the American Society of Heating and Ventilating Engineers, Gustave Debesson, of Paris, France, advises that the French architects are making an effort to have heating engineers include in their specifications clauses guaranteeing the quantity of coal burned during a winter in new heating plants. Mr. Debesson asks American heating engineers to ad-

vise him if they are ever asked to estimate the amount of coal that will be burned in such a plant for an hour, day, month or for the heating season; also if tests are ever made of heating plants to show the fuel consumption and who pays for such tests.

### Webster Air Washer and Humidifier

A new air washer, known as the Webster Air Washer and Humidifier, has been placed on the market by Warren Webster & Co., Camden, N. J., and is illustrated herewith. It consists principally of a spray chamber and an eliminator made of galvanized iron or copper, which present novel features of construction.

The air to be washed, humidified or cooled passes first into the spray chamber where it is washed and cleansed by passing, as may be desired, through from two to four sheets of water, having a combination "rain-and-spray" effect.

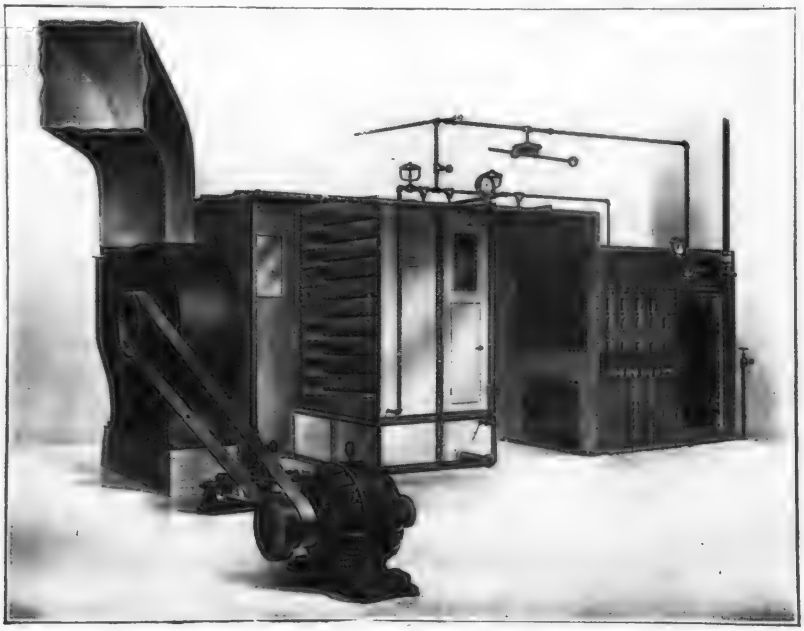
The "rain" and "spray" effects produced by special patented copper spray heads were selected because it was found that sheets of rain more effectually removed dust and dirt from the air, whereas sheets of finely divided spray, on account of the more intimate contact possible between the air and water, had a greater cooling effect.

After leaving the spray chamber the air passes through the eliminator, where all entrained water or unevaporated moisture is entirely removed; thence through to the ventilating system into the building.

The special feature of the Webster eliminator is the use of horizontal baffle plates, so that any entrained water deposited upon the baffle plates is carried off at once horizontally to a gutter and returned to the water tank, thus preventing re-contact with the lower strata of air passing through the eliminator.

A water tank or sump which may be made of concrete, galvanized sheet iron or copper, contains the spray water which is circulated at from ten to twenty pounds hydrostatic pressure by means of a centrifugal pump.

WEBSTER AIR WASHER AND HUMIDIFIER



VIEW SHOWING COMPLETE INSTALLATION OF THE WEBSTER AIR WASHER AND HUMIDIFIER

# TRADE AND MISCELLANEOUS NOTES

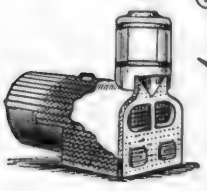
## Deaths

**Edward Dickerson Crook,** president of the Crook-Horner Co., machinists and heating contractors, Baltimore, Md., died in that city, Dec. 5. He was born in 1857. He established the firm of Crook, Horner & Co., in 1882, which later became the Crook-Horner Co. The other members of the firm are his brothers-in-law, Edgar F., Harry C., and George A. Horner.

**Theodore L. Webster,** secretary of Warren Webster & Co., Camden, N. J., met his death in a rear-end collision, Dec. 27, 1907, on the Pennsylvania Railroad at Camden. He was 37 years old. His brother, Spencer Webster, was in another part of the same train, but escaped uninjured. Mr. Webster had been connected with Warren Webster & Co., since its establishment in 1887. When he joined the firm it was located in Philadelphia and was known as Webster Bros. The business grew rapidly and in 1888 the name was changed to Warren Webster & Co. The unusual success of the company necessitated larger quarters and a factory was built in Camden. In 1895 the business was incorporated with Warren Webster as president, Theodore L. Webster, secretary, and A. Spencer Webster, treasurer. As secretary of the company Mr. Webster came into daily contact with a large number of prominent architects, engineers and public officials with whom the company did business in the manufacture and sale of feedwater heaters and steam specialties, and his genial qualities and sterling integrity in all his business transactions won for him the respect of every one who met him. He leaves a widow.

**James B. Clow,** founder and president of Jas. B. Clow & Co., Chicago, manufacturers of heating and plumbing supplies, died Jan. 7, of pneumonia. He was 75 years old. Mr. Clow was one of the pioneers in the manufacture of heating and plumbing goods in this country and

TELEPHONE CALL 6097 FRANKLIN.



ROBERT A. KEASBEY CO.

HEAT AND COLD INSULATING MATERIALS

HEADQUARTERS FOR
85% MAGNESIA, ASBESTOS AND BRINE
PIPE COVERINGS, ASBESTOS PRODUCTS, ETC.

ESTIMATES FURNISHED AND CONTRACTS EXECUTED.

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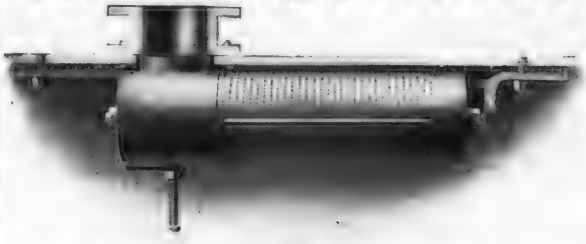
SAFETY AND ECONOMY



are both increased by using "THE POTTER" MESH SEPARATOR, the only efficient boiler dry-pipe.

We guarantee dry steam at the boiler outlet, and make good our guarantee.

WRITE FOR BOOKLET

POTTER SEPARATOR CO., - - 4 Front Street, NEWBURGH, N. Y.
New York Office, 39 Cortlandt Street

was widely known. He established the firm of which he was the head in 1878. He leaves five sons, four of whom are prominently identified with Jas. B. Clow & Co., and the fifth, Harry B. Clow, is president of Rand, McNally & Co., the publishers.

**Alfred M. Hewlett,** president of the Western Tube Co., Kewanee, Ill., died at his home in that city, Dec. 20, of paralysis. He was born in Jeffersontown, Ky., in 1850 and had lived in Kewanee since 1875. He was made president of the Western Tube Co. in 1904.

### Manufacturers' Notes

**D. T. Williams Valve Co.,** Cincinnati, O., is building a new five-story plant of reinforced concrete, 50x227 ft., on Hunt street, in that city.

**William M. Mackay,** New York, has been granted a patent on a wall radiator, the distinctive feature of which is a horizontal instead of vertical cross run. New boiler patents have also been allowed Mr. Mackay. All types of his boilers as well as radiators are manufactured by the McCrum-Howell Co., New York.

**Utica Heater Co.,** Utica, N. Y., announces the addition to its sales organization of Fred B. Edell, formerly of Hart & Crouse Co., Henry Cowles, formerly of Giblin & Co., and Frank McKinley, formerly of John Weekes & Son Co., Watertown, N. Y. A vigorous campaign in the sale of Imperial boilers and Superior furnaces is planned for 1908.

**National Tube Co.,** Pittsburg, Pa., has consolidated the sales departments of the Western Tube Co. and the Shelby Steel Tube Co. with its own sales department at Pittsburg, the organization being made up as follows: First vice-president and general manager of sales, Edward C. Worcester; assistant general managers of sales, James W. Downer and H. S. White. Additional branches have been established, making the total number nine instead of five, located in New York, Pittsburg, Chicago, St. Louis, San Francisco, Portland, Ore., Denver, New Orleans and Atlanta.

**Curtis & Curtis Mfg. Co.,** Bridgeport, Conn., manufacturers of pipe threading machinery, has added 8,000 sq. ft. to its plant by raising the roof of one of its main buildings.

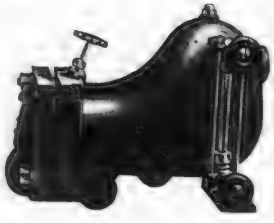
**Wells Bros Co.,** Greenfield, Mass., manufacturers of pipe threading machinery, is erecting a new building 100x30 feet, one story high, to its plant, which will greatly increase its capacity. A new boiler has been installed.

### Miscellaneous Notes

**National Council of Commerce** is the name of a new body of business men, comprising 34 commercial organizations, formed at Washington, D. C., Dec. 5, 1907, at the Department of Commerce and Labor in the office of Secretary Straus. The purpose of the movement is to form a closer association between the business world and the Department of Commerce and Labor, with a view to mutual co-operation in extending and bettering trade conditions. The delegates were received by President Roosevelt. Headquarters will be established in Washington.

**McDaniel Improved Steam Trap**

**WILL DO THE WORK**



When you need a Steam Trap buy one you know will work. With a McDANIEL we take all the chances. Don't pay until you are satisfied. We have been 25 years manufacturing Steam Traps and know there is no better trap made. May we send you one for trial?

**Watson & McDaniel Co.**

**160 North 7th Street - PHILADELPHIA, PA.**

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**THERMOSTATIC EFFICIENCY**

**NATIONAL REGULATOR CO.**

**CHICAGO** **NEW YORK**

**A decree** in the case of the State of Ohio against a number of Ohio manufacturers and dealers in plumbing supplies, including the J. H. McLain Co., the E. W. Foster Co., The Kennedy Co., and the Sanitary Co., members of the Central Supply Association, declaring that the so-called "Detroit Trade Resolutions" were an agreement in restraint of trade and therefore unlawful, was entered Dec. 20, 1907. As the Central Supply Association and the National Committee of the Confederated Supply Associations had rescinded the resolutions in question, the entering of the decree was not contested.

**London, Eng.**—A committee appointed by one of the government departments is investigating the subject of artificial humidity in cotton weaving factories in England with special reference to the temperature and humidity necessary for the manufacture of different classes of cotton fabrics, what degrees of heat and humidity combined produce discomfort under the conditions of the work engaged in by operatives and what arrangements are necessary for the ventilation of dry weaving sheds.

**Building returns** from leading cities for the latter part of 1907 show a notable falling off as compared with those for the previous year, some of the figures running as high as 51% below those of the corresponding period a year ago.

**Thomas T. Tait,** heating and plumbing engineer, has been appointed consulting engineer for the MacMahon Co., Kansas City, Mo.

**International Congress of the Refrigerating Industries,** now being organized under the patronage of the French ministers of agriculture, commerce and industry, colonies and marine, will hold an international conference in Paris next July. The purpose is to bring together leading experts from countries where refrigeration is used to preserve food in transportation by land or sea.

**A new Spanish composition** for preserving steam boilers has been placed on the market in Barcelona, Spain. It is a colorless and odorless liquid. When placed in water tanks from which boilers are filled the composition, it is claimed, will precipitate all impurities in the water adhering to the sides of the boiler tubes.

**Technical Literature,** 220 Broadway, New York, the new monthly magazine of technical information for engineers, designers and constructors, has changed its name to "The Engineering Digest."

**San Francisco, Cal.**—A demand by the labor union leaders that the pipe fitting in connection with the installation of elevators in the Mills Building should be done by steam fitters instead of by members of the Elevator Constructors' Union, who have done the work in the past, has led to a strike which has practically


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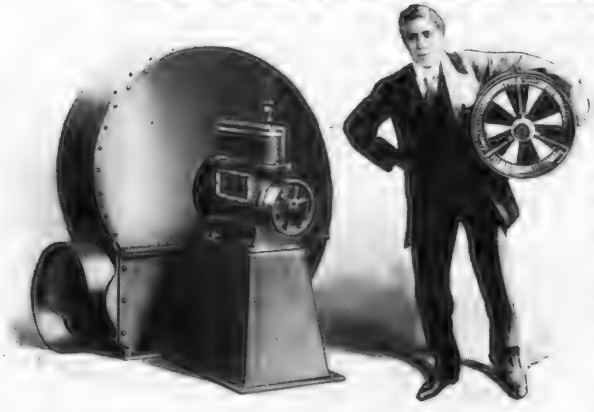

means guaranteed economy of fuel, increased boiler capacity, absolute simplicity.

First and operating costs less than any other system and equals the results of the best.

Requires no floor space and little attention.

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The Small Fan under the man's arm takes the place of the large blower and engine.

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West and Cedar Sts.
NEW YORK

Mfrs. Wing's Disc Fans, Blowers and Exhaust Fans

Designers and Builders of Heating and Ventilating Systems

stopped work on the building. The contractors threaten to sue the local Building Trades Council for damages.

**Chicago, Ill.**—Recent tests of flanged fittings conducted by the Crane Co., and reported in the Valve World, show the bursting point, under hydraulic pressure, to be 2,066 lbs. for ferrosteel fittings and 1,263 lbs. for cast-iron fittings.

**Syracuse, N. Y.**—A committee appointed by the Chamber of Commerce of Syracuse to investigate the subject of smoke prevention in Syracuse has made a report in which it states that an investigation of the efforts made in other cities, especially Detroit, Cleveland, Chicago and Milwaukee, indicates that noteworthy progress has been made in the abatement of smoke and that much can be done in cities like Syracuse. It is stated that success will depend very materially on the co-operation of those operating boiler plants. Among the members of the committee is Professor William Kent, of Syracuse University.

**St. Paul, Minn.**—The American Bridge Co., New York, is suing to collect the balance due upon a mechanics' lien of $89,000, covering the power plant in St. Paul built by the bridge company for the Northern Heating and Electric Co. The defendants are the Northern Heating and Electric Co., the American District Steam Co., and the Northern Manufacturing Co. A portion of the account of $63,000 has been paid. The defendants assert that the balance is offset by various counter claims.

**Walter B. Snow,** publicity engineer, Boston, has been elected president of the Alumni Association of the Massachusetts Institute of Technology.

**Bloomington, Ill.**—As the result of a number of pipe failures in its central station hot water heating system, the Bloomington & Normal Railway & Light Co. has sent out a letter to its patrons, advising them that it will be unable to guarantee efficient service this winter to those using its hot water heat.

**Mangrum & Otter,** San Francisco, Cal., suffered the loss of nearly their entire stock of heating supplies in a fire Dec. 26, which destroyed their quarters at Mission and Ecker streets.

### New Incorporations

**David Stone Co.,** Brooklyn, N. Y., capital $8,000, to conduct a heating and plumbing business. Incorporators: Julius Brown, Harry Shiller and Israel Rothstein, all of Brooklyn.

**Eppel-Schlosser Co.,** Muscatine, Ia., capital $12,000, to conduct a heating and plumbing business. Incorporators: Louis P. Schlosser and Frank J. Eppel.


# Zinc-Coated Steel Slip Nipples

**For Steam and Hot Water Radiators and House Heating Boilers**

# THE PRATT CHUCK CO., Frankfort, N.Y.

**FREE SAMPLES furnished to interested parties**

**F. C. Farnsworth & Co.,** Brooklyn, N. Y., capital $10,000, to engage in steam and hot water fitting. Incorporators: Fred C., Edward G., and G. F. Farnsworth, all of Brooklyn.

**J. C. Archer Plumbing Co.,** Los Angeles, Cal. Capital, $5,000.

### Business Chances

**Minneapolis, Minn.**—The Knights of Columbus will build a clubhouse to cost $40,000. A modern heating system will be installed. M. C. O'Donnell, recorder, 322 Nicollet avenue.

**Washington, D. C.**—The Isthmian Canal Commission will invite tenders for malleable black and galvanized iron fittings, extra heavy fittings, seam traps, unions, bibbs, and brass goods for steam. The commission's circular may be had on application at Washington, D. C.

**Washington, D. C.**—Sealed proposals will be received at the office of the Supervising Architect, Treasury Department office until 3 P. M., February 11, 1908, for the construction (complete) of the extension to the U. S. Post Office and Court House at Chattanooga, Tenn.

**Washington, D. C.**—Sealed proposals will be received at the office of the Supervising Architect, Treasury Department until 3 P. M., February 14, 1908, for the construction (including plumbing, gas piping, heating apparatus, electric conduits and wiring) of the U. S. Post Office and Court House at Bluefield, W. Va.

**Zepp & Buttermore,** Cornellsville, Pa., has succeeded Zepp & Rutsek, Mr. Rutsek retiring and Albert J. Buttermore becoming a member of the firm.

### New Firms

**Burns & Glickman,** Newark, N. J., have engaged in the heating and plumbing business at 173 Court street.

**Donohue & Smith,** Buffalo, N. Y., is a new heating and plumbing firm located at 204 Seneca street. N. J. Donohue and L. A. Smith are the members of the firm.

**Edward K. Monroe,** Baltimore, Md., has opened an office as a consulting, heating and ventilating engineer and contractor at 106 South Gay street.

### Trade Literature

**Massachusetts Fan Co.,** Watertown, Mass., has just issued an additional section of its perpetual catalogue. This section, which comprises 16 pages, and is entitled "Vertical and Horizontal Engines for Fan Driving," includes illustrations, descriptions, dimensions, and horse-power tables. The entire catalogue is thus brought up to a total of 116 pages of valuable matter relating to blowers and exhausters, heating, ventilat-

UTILITY Exhaust Muffler, Oil Separator, Return Tank Pump Governor and Feed Water Heater

UTILITY Vertical Steam Receiver and Separator

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Specify **Utility** Specialties in your work and we will guarantee their value in use.

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**542-544 WEST BROADWAY, NEW YORK**

ing, drying and mechanical draft apparatus, etc.

**Pierce Herald** for December, 1907, calls renewed attention to the facilities of the Pierce, Butler & Pierce Mfg. Co., Syracuse, N. Y., for furnishing plumbing as well as steam and hot water fittings so that shipments of both classes of material may be made from one shipping point.

### Contracts Awarded.

**J. A. Devaney,** Hastings, Minn., heating St. Joseph's Catholic Church, Miesville, Minn.

**H. R. Boynton Co.,** Los Angeles, Cal., award for supplying Los Angeles Water Board with 50,000 ft. of ½-in. pipe, $2,607.

**Stoll & Palmquist,** Kane, Pa., plumbing and steam-heating new Thompson Hotel, that city.

**Fetter & Mates,** Turtle Creek, Pa., heating four-story banking and office building for the Turtle Creek Savings Bank, that place.

**Gannon & Casey,** Erie, Pa., vacuum steam-heating new St. Mary's College at North East and St. Mary's Home for the Aged at Erie; also steam-heating and plumbing for the new buildings of the State Soldiers' Home.

**H. P. McGrath,** Dayton, O., steam-heating apparatus for the addition to Steele High School Building, that city.

**Willey & Calhoun,** Portland, Me., steam-heating plant in new $100,000 Town Hall at Sanford, Me. Two Mercer boilers will be used. Also steam-heating Thompson-Johnson apartment building, Portland.

**Rogers & Varney Co.,** Fort Fairfield, Me., Norwall vacuum system in Frontier Trust Co.'s new brick building, that place.

**Wales & Hamblen,** Bridgeton, Me., steam-heating First National Bank Building, that place.

**A. L. & E. F. Goss,** Lewiston, Me., heating and plumbing new $100,000 Elks' Building, that city.

**Gideon Pitcher,** Waterville, Me., heating new St. Mary's church, that city.

**Buell Bros.,** Fulton, N. Y., steam-heating City Hall, that place.

**Huffman & Conklin,** Columbus, O., heating and ventilating new Manual Training School's $145,000 building at Dayton.

**James McGillan,** Rockford, Ill., heating plant for condensing factory at Huntley.


**THE SCHOOL HOUSE,** ITS HEATING AND VENTILATION

**By JOSEPH A. MOORE,** *Inspector of Public Buildings, State of Massachusetts*

The author having been for the last eighteen years engaged in the inspection of public buildings in Massachusetts, and in supervising the construction of and testing the various methods of heating and ventilation, especially in school houses, presents to those interested in our public schools some suggestions as to the construction and the heating and ventilation of such buildings. The class of buildings selected are those of small or moderate size, of which many are erected each year.

The author does not attempt to give theoretical or scientific descriptions or arguments, but simply such methods and plans as have been proved by actual experience to give satisfactory results.

Many of the plans were designed by the author for the annual official reports of the late Rufus R. Wade, chief of the Massachusetts district police.

The method of setting up indirect radiators, as shown in the plans and now generally adopted in Massachusetts, was designed by Mr. Moore, and first published in drawings which formed part of the official exhibit of the inspection department of the Massachusetts district police at the Columbian Exposition at Chicago in 1893, and for which an award was given.

Other plans formed part of the exhibit at the Paris Exposition in 1900, for which an award was also given, and at the Louisiana Purchase Exposition at St. Louis. **204 pages, illustrated. Price, $2.00**

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**John Dieterle,** Sterling, Ill., heating Fourth Street Methodist Church.

**Joseph Neve,** Superior, Wis., steam heating and plumbing three-story brick addition, 45x85 ft. to the normal school at Superior.

**Johnson-Wyth Co.,** Des Moines, Ia., heating and plumbing new Carpenter block.

**M. A. Bowers Heating Co.,** Milwaukee, Wis., heating and ventilating plant for the Milwaukee Hippodrome. The contract amounts to $8,230. O. P. Zimmerman, of Milwaukee, has the plumbing contract. The Hippodrome will be formally opened New Year's Eve, 1908. The building will cost $420,000.

**Cragin - Wilkens Co.,** Leominster, Mass., ventilating new chair factory in Gardner.

**A. P. Bateman & Son,** Winchenden, Mass., steam heating the Arthur L. Brown residence in Winchenden.

**Mullen Bros.,** Dubuque, Iowa, heating and plumbing new Infirmary Building in that city.

**J. C. St. John,** Colorado Springs, Colo., heating new Post Hospital at Fort A. D. Russell, Wyoming.

**Manuel-Smith Heating Co.,** Minneapolis, Minn., heating Opera House at Dawson, Minn.

**Alexander Duncan,** Boston, Mass., piping for both heat and power at the new Roper factory at Hopedale.

**Elwood Adams,** Boston, Mass., power equipment, at Clark University.

**T. M. Lemfesty,** Carnegie, Pa., steam-heating $50,000 amusement hall and arcade for the Carnegie Amusement Co., at that place.

**A. O. Ulery,** Gambier, O., hot water heating new Carnegie Library Building at Westerville, O.

**Mangrum & Otter,** San Francisco, Cal., steam heating and oil-burning system for Postal Telegraph Building.

**California Hydraulic Engineering and Supply Co.,** San Francisco, Cal., steam heating reconstructed Chronicle Building.

**W. D. Bunce,** Franklin, Pa., hot-water heating $25,000 residence in Miller Park, for Frederick Haskell.

**P. F. Maginn & Co.,** Pittsburg, Pa., hot-water heating J. B. Berger's apartment building at New Castle, Pa.

**Iron City Heating Co.,** Pittsburg, Pa., heating new $300,000 convent for the Academy of Our Lady of Mercy.

**Bray & Moore Engineering Co.,** Benton, Ill., hot-air heating system for new public school building, Christopher, Ill.

WEBSTER STEAM SPECIALTIES

## Small Pipes.

When the big Tribune Building in New York was raised from ten to twenty stories, the steam heating pipes were found too small for the increase. Must they all be torn out and replaced?

THE WEBSTER SYSTEM OF STEAM CIRCULATION

solved this awkward problem. With this system, steam at low pressure circulates perfectly through pipes so small that no other system can be successfully used.

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## Says Portland Conduit is Best Underground Steam Pipe Insulation

MOUNT HOLYOKE COLLEGE

SUPERINTENDENT'S OFFICE

SOUTH HADLEY, MASS., March 23, 1905

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Gentlemen:—We are much pleased with the Portland Sectional Conduit, of which we have about 4,000 feet in use. We formerly made use of the brick tunnels as underground conduit for the steam pipes, and we find that the Portland Sectional Conduit provides much better insulation and protects the steam pipes, and is not more expensive to construct than other forms of underground conduit.

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1906

**Sodeman Heating and Power Co.,** St. Louis, Mo., steam heating Tuscan Hall Association's new $50,000 building.

**Haynes Landenburg Co.,** St. Louis, Mo., hot-air heating N. Sullivan's apartment building.

**Lookout Steam Heating and Supply Co.,** Chattanooga, Tenn., heating City Hall, that city.

**Geo. Sheerer,** Cedar Falls, Ia., heating and plumbing new school building in Ackley, Ia.

**McDonnell Bros.,** Cedar Rapids, Ia., heating and plumbing Security Savings Bank Building.

**Van Zandt Heating and Plumbing Co.,** Fort Worth, Texas, heating new school building in Cleburne, Texas.

**J. R. Mathews,** Los Angeles, Cal., remodelling steam heating plant in the County Hospital, that city.

**J. J. Walters & Co.,** Johnstown, Pa., heating and plumbing convent of St. Columbia's Church.

**John W. Danforth Co.,** Buffalo, N. Y., steam heating new electric light plant at Dunkirk, N. Y., for $2,500.

**R. T. Ford Co.,** Rochester, N. Y., heating new Convention Hall in that city, for $1,527.

**J. R. Smith,** Oneida, N. Y., plumbing, heating and high-pressure systems for James A. Spargo Co.'s new mill at Rome, N. Y.

**O'Toole Bros.,** Clinton, Mass., remodelling steam heating plant in the County Truant School at Oakdale.

**Cragin-Wilkins Co.,** Leominster, Mass., ventilating new chair factory in Gardiner, Mass.

**Pennsylvania Supply Co.,** Jeanette, Pa., plumbing and vacuum heating systems for the Franciscan College's new buildings at Loretto, Pa.; also for the Glass City Bank Building at Jeanette, and the Nattman Building at Barnesboro, Pa.

**American Ventilating, Heating and Supply Co.,** Pittsburg, Pa., fan system of heating and ventilating for the new $200,000 public school building, Northside.

**West Latrobe Foundry and Machine Co.,** Latrobe, Pa., steam heating $75,000 addition to St. Xavier's Academy of the Sisters of Mercy, at Beatty Station, Pa.

**Henry Niemes,** Cincinnati, O., heating new St. Mary's Parochial School building.

**Dibble & Burns,** Schenectady, N. Y., heating and plumbing Union College buildings in that city.

**Joseph W. Mitchell,** Madison Wis., was the lowest bidder of seven contractors submitting bids to the Wisconsin Capitol Commission for the construction of the tunnel between the separate heating and storage plants and the State House, and for the razing of the old capitol. His bid for constructing the tunnel was $42,000.

**Klinsmann Co.,** Fargo, N. D., heating Stacy Fruit Co.'s new building at Bismarck; also heating new bank of Wheelock & Wheelock at Medina, N. D.

**Peninsular Plumbing and Heating Co.,** Calumet, Mich., heating and plumbing Calumet Y. M. C. A. Building.

**J. D. Green,** Urbana, Ill., plumbing and heating new University Club House, for $2,000.

**D. T. Beaton,** Manchester, Mass., hot-water heating system in Prescott & Co.'s building, Dock Square, Boston.

**Evans, Almirall & Co.,** New York, heating and ventilating new High School building at Haverhill, Mass.

**Healey Plumbing and Heating Co.,** St. Paul, Minn., plumbing, heating and lighting American Surety's new building.

**Bannigan, Cooper & Stressel,** Utica, N. Y., plumbing, steam heating and high-pressure piping in International Paper

**Commonwealth Hotel**
**Opp. State House, Boston, Mass.**

Offers rooms with hot and cold water for $1.00 per day and up; rooms with private bath for $1.50 per day and up; suites of two rooms and bath for $3.00 per day and up. Weekly rates on rooms with hot and cold water and shower baths, $6.00 to $9.00; rooms with private baths, $9.00 to $12.00; suites of two rooms and bath, $15.00 to $22.00. Absolutely fireproof. Stone floors, nothing wood but the doors. Equipped with its own Sanitary Vacuum Cleaning Plant. Long distance telephone in every room. Strictly a temperance hotel. Send for booklet.

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**LOW PRESSURE STEAM HEATING CHARTS** for dwellings and other small buildings constructed of various materials, with descriptive notes. $1.00 ‡.

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Co.'s mill at Bierceficld, N. Y.; steam heating new Kenmore store and apartment block; steam heating and plumbing in the plant of the Stittville Knitting Co., Stittville, N. Y.; also dry kiln in plant of the American Casket Co., at Oneida, N. Y.

**John A. Montgomery,** Astoria, Ore., heating new Clatsop County Court House in that place.

**Buell Bros.,** Fulton, N. Y., steam heating Fulton City Hall.

**B. B. Shine,** Green Bay, Wis., heating St. Vincent's Hospital at Green Bay.

**Stille & Puisant,** Escanaba, Mich., heating St. Anne's School and Convent.

**Finch & Lee,** Stevens Point, Wis., steam heating Green Bros.' block in that city.

**Neil & Co.,** Superior, Wis., heating and plumbing new addition to Superior Normal School.

**J. A. Buckley & Son,** Longmont, Col., plumbing and heating new Odd Fellows' Building.

**Hurley & Co.,** St. Paul, Minn., plumbing and heating four duplex houses for Mark Fitzpatrick.

**Gannon & Casey,** Erie, Pa., plumbing and steam heating new commander's residence at the State Soldiers' Home, near Erie; also vacuum steam heating systems for St. Mary's Home for the Aged, in Erie, and St. Mary's College at North East, Pa.

**Natt, Boseham & McFarland, Inc.,** Rochester, N. Y., steam heating new Turkish Bath Co.'s building.

**Martin & Wigman,** Green Bay, Wis., heating and ventilating St. Mary's School in that place.

**Andrews Heating Co.,** Minneapolis, Minn., heating first ward school in Ladysmith, Wis.

**G. S. Blodgett Co.,** Burlington, Vt., heating and plumbing new Federal Building in Burlington; heating, plumbing and ventilating Senator Proctor's new Sanatarium at Pittsford; heating, plumbing and ventilation Dana School at Rutland, Vt.

**Urbauer & Atwood Heating Co.,** St. Louis, Mo., heating Lindell-Gordon Realty and Investment Co.'s new $150,000 seven-story building in that city.

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**Chicago concern,** selling to heating and ventilating contractors throughout the northwest, desires exclusive agencies for steam specialties, pipe covering, mechanical hot blast heating and drying equipment, etc. Address Western, care of THE HEATING AND VENTILATING MAGAZINE.


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## The Maxfield Steam Engine

For belting or direct connecting to dynamos, pumps, blowers, stokers, disc fans and general power 3 H. P. to 30 H. P. All speeds. Small space.

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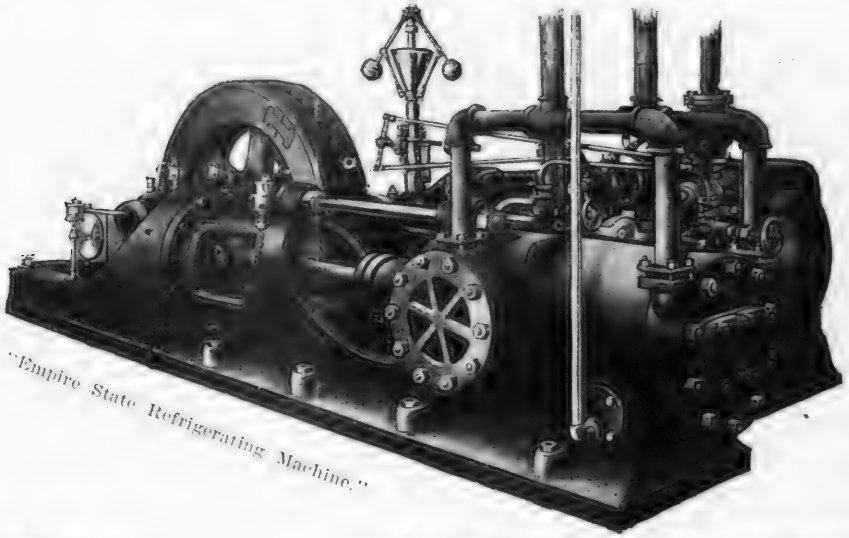


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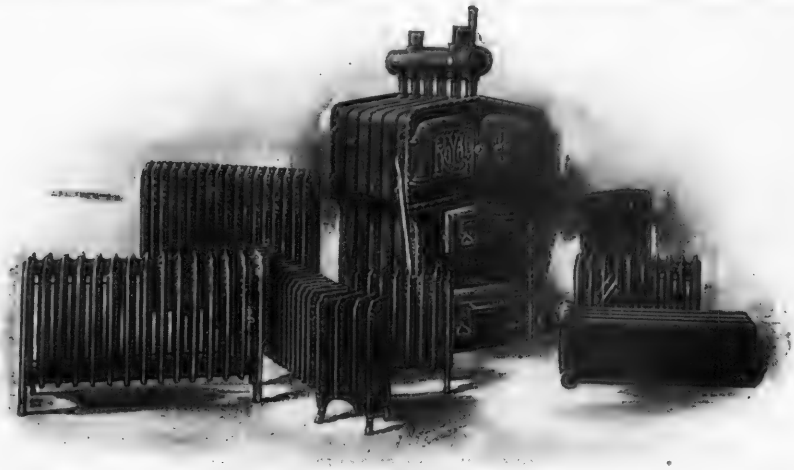

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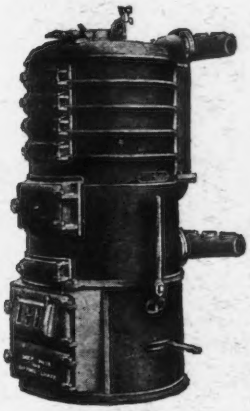
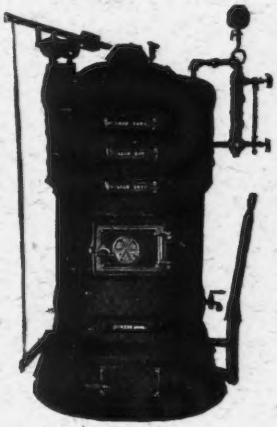


SPENCE



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| FLORIDA | IMPROVED GIANT | TROPIC | TROPIC, JR. |
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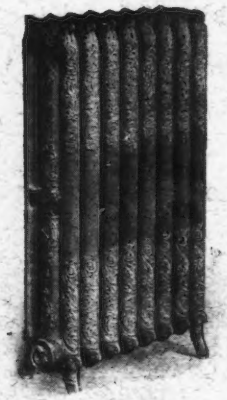
# Absolute Tests

The size, shape and position of the heating surfaces and of the air ducts formed by the spaces or distances between them, combine to give AMERICAN Radiators a capacity for heat transmission per square foot per hour which is in excess of other forms of heating surface offered to the Trade.



ROCOCO THREE-COLUMN RADIATOR

As fair tests have developed in the AMERICAN Rococo pattern a heat radiating capacity of 80 per cent. in excess of one competing type (under exactly similar conditions), it proves that this highly developed capacity is most important to successful heating work.

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AMERICAN RADIATOR COMPANY

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